DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

OCTOBER, 1952 VOLUME 50 • NUMBER 10

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COMING SOON

Short cut in the calculation of nickel sulfate and nickel chloride in the analysis of Watt's type nickel plating solution.

Use of radioactivity to explore the behavior of brighteners in silver solutions.

Results of attempt to electrodeposit zinc on uranium in the laboratory.

Practical methods of applying thin, mirror-finish layers of metal to plastic, glass and metal surfaces.

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 Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

The WASHINGTON OBSERVER

Charles A. Cerami

News and Views from The Nation's Capitol

. Assistance to the hard-hit nickel platers was granted on Sept. 3rd by NPA, in amending Schedule 1 of order M-80. They are now permitted to use nickel in a "strike" up to an average thickness of 0.0005" for a protective coating under electrodeposited chromium on articles where such use heretofore was prohibited. This action, however, will not involve any additional allocation of nickel anodes or chemicals to the electroplating industry, NPA said.

. Members of the Stainless Steel Industry Advisory Committee were told last month by officials of NPA that the supply situation for nickel is unchanged and any relaxation of controls on nickel is not likely, at least during the next year. However, it was also announced that, beginning with October, authorization for the purchase and use of all allocated alloying materials, which includes nickel, will be issued covering three months instead of on a monthly basis.

. Secretary Sawyer recently instructed Department of Commerce economists, working in conjunction with the Committee for Economic Development, to produce by January 1, 1953, a study of markets prospectively available when present defense production levels off.

. Requirements for reporting ceilings on certain new chemical specialties, such as cleaning and electroplating compounds, which are mechanical mixtures, have been simplified for manufacturers, the Office of Price Stabilization announced a few weeks ago.

. Copper ceilings were raised nearly 4¢ per pound on Sept. 8th when the Government authorized manufacturers to pass on recent ceiling-price increases to distributors. Wholesalers and retailers automatically may pass them on to consumers and add their pre-Korean percentage mark-up.

. The American Zinc Institute, worried about substitution for zinc, which is still being urged in Washington, points out that the availability of zinc is assured in the near and long-range future, and that zinc is no longer classified as a critical and scarce material.

. Aluminum and copper inventory curbs have been eased. NPA authorized accumulation of 60-day inventories of aluminum and copper controlled materials during the fourth quarter of 1952 in an amendment to CMP Regulation 2, the inventory order.

. According to a CMP amendment, any person may acquire foreign and used steel to produce Class A and B products without charging same against his authorized allotment.

. Inventory controls were removed from a number of chemicals during Sept., including polyethylene and sulfuric acid. This reflects the change in the supply-demand situation.

. Members of the Selenium Rectifier Stack Manufacturers Industry Advisory Committee have told officials that continued tightening of selenium supplies in the face of military requirements may mean reduced quantities of rectifiers, after hearing the government report that demand for selenium of all grades will probably outstrip supply for an indefinite length of time.

. Controls on second-quality steel have not been relaxed and this type of steel is still subject to all the regulations of a CMP material. Any steel that is not prime steel comes under this category.

ESTABLISHED 1903

OTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

OLUME 50 • NUMBER 10 • OCTOBER 1952

Now It's Legal

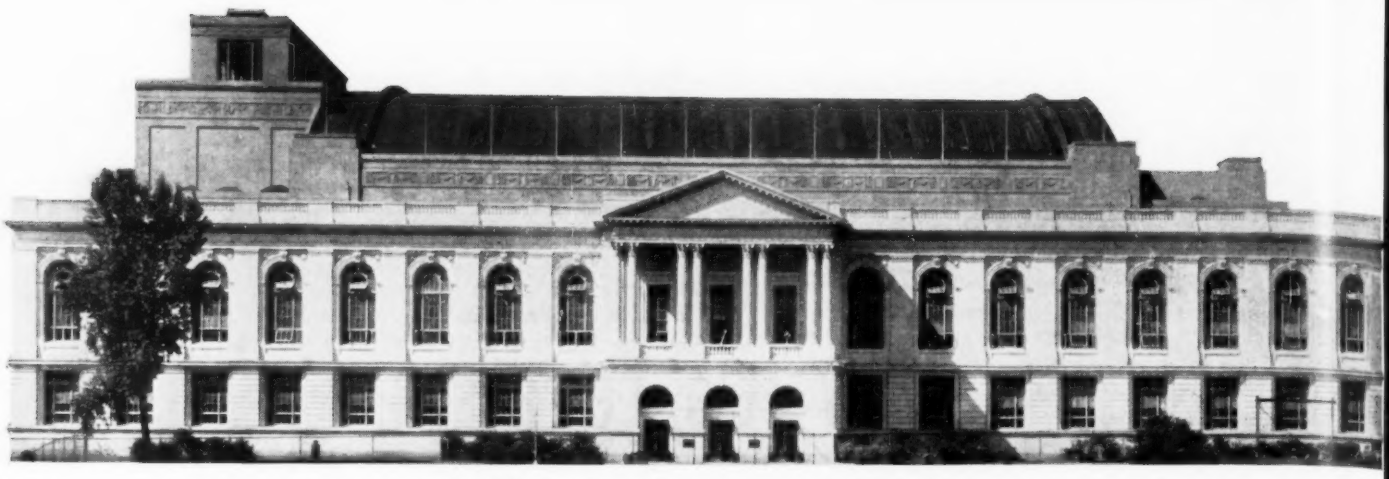
On September 3rd, the National Production Authority finally took a long overdue step when it revoked the prohibition on nickel plating of a long list of "unessential" items and substituted a limitation of 0.00005" average thickness of nickel as a base for chromium on the products on Lists A and B of Schedule 1 to NPA Order M-80. According to NPA, the amendment "*recognizes the functional necessity for a very thin nickel coating as a base for chromium and places the electroplating industry on the same footing of nickel usage as in the vitreous enamel and silver plating fields.*"

In other words, NPA has finally awakened to the ridiculous inequality of an order which permitted the use of nickel as a base for a silver plated tray but prohibited its use as a base for a chromium plated one, where the prohibition would definitely result in an inferior product. Personally, we never could understand the logic by which a nickel undercoat of 0.0001" was considered essential for gold plated jewelry, while the same undercoat for a chromium plated badge exposed to the weather was prohibited — and we still can't understand on what scientific basis it was decided now that only half as much nickel is necessary under chromium than is considered necessary under gold or silver.

For the benefit of users who dropped out of the nickel market because their products were on the prohibited list, we would remind them that, for civilian requirements, a user is permitted to order each month 25% of his average monthly purchases from his supplier during the highest six month period ending June 30, 1949, December 31, 1949 or June 30, 1950. Any person receiving less than 100 lbs. monthly of nickel, in the form of anodes or salts, can be supplied on the Small Order Certification, but others must state that the nickel is to be used for nickel striking. The proper statements to be included on the purchase order can be obtained from the supplier.

It should be understood that nickel is still in very short supply and bids fair to remain that way, so that permission to order does not guarantee delivery. However, unless an allocation request is made of the supplier, to be filed by him with NPA, no consideration can be given the plater's requirements if a small amount of nickel should be made available for civilian uses.

Nathaniel Hall



Philadelphia Municipal Auditorium Seen at the 1952 Metal Show

National Metal Congress and Exposition

To Be Held In Philadelphia, October 18-24

WITH Philadelphia as its 1952 meeting place, the 34th annual National Metal Congress and Exposition will open on Saturday, October 18. The National Metal Exposition held concurently will open on Monday, October 20, and remain open through the 24th.

Technical meetings of the American Society for Metals will be held at Hotel Benjamin Franklin; the American Welding Society at the Bellevue-Stratford Hotel; Institute of Metals Division, A.I.M.E. at Hotel Adelphia; Society for Non-Destructive Testing at Hotel Sylvania. College alumni luncheons will be held on Wednesday at downtown hotels.

While no technical papers directly concerning the field of this publication are to be presented, many of our readers with interest in general metallurgical subjects will want to attend. The theme of this year's Congress is "Metal Keeps the Peace." According to W. H. Eisenman, over 400 nationally-known firms engaged in either the production of metals, the treatment of metals, the fabrication of metals into component parts or products; or in rendering services to all of these will use exhibit space.

These exhibitors will use 210,000 square feet of floor space —nearly 5 acres— for the display and demonstration of their products, equipment or services. In addition, thousands of square feet of space have been set aside for special meetings, forums, lectures and other activities connected with the Congress and the Exposition.

The Exposition is being held at the Philadelphia Convention Hall and Commercial Museum, which is near the 30th Street Station of the Pennsylvania Railroad.

The managing sponsor is the American Society for Metals with headquarters at 7301 Euclid Avenue, Cleveland 3, Ohio.

There will be a number of exhibitors of interest to executives in the Metal Finishing field. The following list gives the exhibitors' names, addresses of the main office, booth number, description of exhibit, and personnel in attendance, where such information has been furnished us:

Acme Manufacturing Company

1400 East Nine Mile Rd., Detroit 20 (Ferndale), Mich.

No. 1716—Acme 66" Combination seven-station Indexing and 21 spindle Continuous Rotary Automatic Polishing and Buffing Machine as well as Automatic and Semi-automatic Polishing and Buffing Equipment. A. Losey, R. Wesler, L. Major and George Carlson.

Alpha Metals, Inc.

56 Water Street, Jersey City 4, N. J.

No. 1862—Alpha Tri Core "Leak-Pruf" Acid Filled Solders will be exhibited but this firm manufactures anodes and information will be available on anodes for plating. H. Shonberg, Pres.; H. Hertzog, Vice-Pres.; P. Tort, Chief Engr.; M. Boyle, Field Mgr.; I. Isaacson, Field Mgr.; R. Shonberg, Sales Engr.; O. Pessel, Sales Engr.; G. Coleman, Sales Engr.; M. Schwarz, Sales Engr.; N. Bilsky, Sales Engr.; W. Watson, Sales Engr.; R. Janke, Research; R. Keller, Chem. Engr.; F. Disque, Chief Engr.; F. Morello, Production Mgr.

Alvey-Ferguson Company

625 Disney Street, Cincinnati 9, Ohio

No. 530—A full size single stage metal parts washing machine, in operation, equipped with glass vision panels and marine lights to permit internal inspection under normal operating conditions. Don Smith, Sales Mgr.; Lee Stigler, Sales Engineer.

American Platinum Works

231 N. J. R. R. Ave., Newark 5, N. J.

Anodes.

American Wheelabrator & Equipment Corp.

Mishawaka, Ind.

No. 1749—Wheelabrator Cabinet used for cleaning cylindrical metal parts. Will also have a showing of typical metal products before and after Wheelabrator and Liquamatte cleaning to demonstrate the surface finishes obtained.

Baker & Co., Inc.

113 Astor Street, Newark 5, N. J.

No. **1210**—Platinum Laboratory Ware; Wollaston Wire. M. M. Waller, I. W. Sheppard, M. H. Muller, D. H. Oberreit, L. E. Crane, W. A. Moorhouse, F. L. Damarin.

G. S. Blakeslee & Co.

1844 - 52nd Avenue, Chicago 50, Ill.

No. **540**—Liquid Vapor Degreasing Machine in complete operation. This machine is being fabricated at the present time. J. H. Fryer, R. B. Thompson, J. R. Cessna, S. E. Maynard, P. R. Foy, C. D. Underwood, C. G. Lindberg, H. N. Arnold, P. H. Johnson, M. B. Pickett.

Detrex Corporation

P. O. Box 501, Detroit 32, Mich.

No. **1849**—Two new and completely redesigned additions to the Detrex VS series degreasers. Also a VS Jr., a semi-portable degreaser for cleaning small and medium sized parts. W. F. Newbery, Director of Sales; L. Camel, G. W. Walter, V. L. Wilker, S. A. Harris, A. D. Chabot, R. A. Emmett, Jr., J. D. Hamacher, T. J. Kearney, W. McCracken, E. J. Hein, C. R. Bauerlein, W. P. Cornyn, R. D. Velsey, D. E. Williard, A. H. Harris, W. A. Erek.

Distillation Products Industries

631 Ridge Road, W., Rochester 3, N. Y.

Vacuum metallizing equipment.

The Diversey Corporation

1820 Roscoe Street, Chicago 13, Ill.

No. **646**—Diversey #909 soak tank cleaner, Diversey #101 electrocleaner for brass, Aluminux for control of scale and sludge in aluminum etching, Divobond for phosphatizing iron and steel prior to painting, and a spray tank of transparent lucite plastic will be used to demonstrate Divobond for phosphatizing iron and steel. R. L. Shannon.

Ekstrand & Tholand, Inc.

441 Lexington Avenue, New York 17, N. Y.

Etolizing process.

Enthone, Inc.

440 Elm Street, New Haven 2, Conn.

No. **1867**—A working demonstration of their new Alkaline Derusting Process. Exhibits of other products and results obtained on various samples will be shown including strippers for dissolving nickel, copper, silver, tin, lead, zinc, cadmium and other metals; Enamel Strippers for removing synthetic enamels and lacquers from all types of base metals and plastics; "Alumon" process for plating aluminum and its alloys for decorative and functional purposes; Cleaners for metals including alkali and emulsion type cleaning materials; Acid inhibitors and pickling agents of various types; and Ebonol blackening processes for metals including iron, copper, brass and zinc." Dr. Walter R. Meyer, President; J. F. Buckman, Executive Vice-President; C. C. Helmle, Sales Manager & Vice-President; H. M. Goldman, Technical Service Engineer; F. A. Schneiders, Chemical Engineer; J. R. Eisele, Sales Engineer; J. H. Shockcor, Sales Engineer.

General Chemical Div., Allied Chemical & Dye Corporation

40 Rector Street, New York 6, N. Y.

No. **1019**—Fluoborate plating solutions and other chemicals.

Globe Stamping Div'n, Hupp Motor Car Corp.

1250 W. 76th Street, Cleveland 2, Ohio

No. **1354**—Tumbling Barrels. R. T. Williams, J. L. Matteson.

Hammond Machinery Builders, Inc.

1600 Douglas Avenue, Kalamazoo 54, Mich.

No. **1130**—Abrasive Belt Grinders, No-Dust Grinders, Polishing and Buffing Lathes. L. N. Albrecht, Dist. representative, S. H. Miller, Grinding and Polishing Machinery Manager.

Handy & Harman

82 Fulton Street, New York 38, N. Y.

No. **110**—Easy-Flo and Sil-Fos silver brazing alloys in action. J. W. Colgan, vice-president in charge of sales; M. W. Townsend, sales manager; A. M. Setapen, manager; F. T. Van Syckel, manager; P. L. Heding, sales engineer; E. E. Tietz, sales engineer; G. J. Van Haste, advertising department; D. A. Kimber, sales engineer; R. J. Metzler, engineering division; A. W. Swift, sales engineer; F. A. Petrie, laboratory technician; M. C. Robbins, manager; E. H. Smith, manager; W. G. Weber, sales engineer; C. D. Coxe, metallurgist.

Harshaw Chemical Co.

1945 - 97th Street, Cleveland 6, Ohio

No. **1420**—Manufacture chemicals, bright plating process but this exhibit will be devoted to laboratory and scientific apparatus. R. Seaman, Philadelphia Branch Manager; W. E. Smith, Detroit Branch Manager; C. G. Chandler, Pittsburgh Sales; R. Beck, Philadelphia Sales; R. Klein, Philadelphia Sales; F. Lucchesi, Philadelphia Sales; D. Miller, Philadelphia Sales; J. M. Manypenny, General Sales Manager.

E. F. Houghton & Co.

303 W. Lehigh Street, Philadelphia 33, Penna.

No. **724**—A new "cold cleaner" consisting of a two-phase combination of Houghto-Clean No. 439 and Houghto-Clean No. 440, operated in power washers at room temperatures, and Houghto Black. D. C. Miner.

International Nickel Company

67 Wall Street, New York, N. Y.

Nickel, Monel Metal. W. H. Prine.

Kelite Products, Inc.

2917 Terminal Annex, Los Angeles 54, Calif.

No. **1260**—Kelite's "No. 28," solvent cleaner; non-flammable, non-toxic, non-explosive, harmless to personnel; specimens displayed showing the paint bonding qualities of Kelite "Keykote," a powdered phosphatizing compound for non-ferrous metals prior to painting. T. Rawlings; William Sorensen, Vice-President; John Emala, Sales Manager; Robert Freeman, Service Engineer.

Knapp Mills, Inc.

23-15 Borden Avenue, Long Island City 1, N. Y.

No. **808**—Lead Lined Tanks, Coils, Pipe, Fittings, Valves, and the Ferrolum Lead Clad Steel and the Cupralum Lead Clad Copper Anode for both decorative and hard chrome plating. James H. Ewing, Robert E. Leonard, John E. English, Alfred P. Knapp.

Kold-Hold Mfg. Co.

735 E. Hazel Street, Lansing 4, Mich.

No. **1462**—"Platecoils" (replaces pipe coils) manufactured from stainless steel and other alloys. Mrs. L. S. Worthington, C. P. Yoder, J. R. Tranter, C. Glennon, R. Roland.

Metal & Thermit Corporation

100 East 42nd Street, New York 17, N. Y.

No. **430**—M & T tin chemicals and anodes for immersion tinning, electrotinning, and liquor finishing. F. J. O'Brien, President; J. B. Tinnon, Vice-President; W. C. Cuntz, District Manager; R. T. Brown, District Manager; N. F. Kiernan, District Manager; C. D. Cooper, District Manager; M. L. Smith, Advertising Manager; H. Buchanan, Chemical Sales.

Mid-West Abrasive Company

Owosso, Michigan

No. 1024—Coated and solid abrasives and abrasive specialties, together with an actual belt sanding operation and a honing operation set up in their booth. R. J. Foresman, Vice-President; P. B. Palmer, Chicago District Manager; D. F. McDonald, Coated Abrasive Field Engineer; G. R. Atkinson, Honing Stone Engineer; H. Breedlove, Abrasive Engineer; L. Hartman, Sales & Advertising.

National Research Corporation

70 Memorial Drive, Cambridge, Mass.

Vacuum metallizing process. George W. Carr.

Oakite Products

19 Rector Street, New York 6, N. Y.

No. 1715—Oakite Compound No. 31, pre-paint metal cleaner that cleans, derusts and phosphates in a single operation; Oakite Composition No. 60 a material designed to produce a heavier, more uniform etch on aluminum; Oakite Composition No. 95, a reverse current conditioner for zinc die castings, designed primarily as an electrolytic conditioner in preparation for plating; and Oakite Stripper R-6 alkaline material for removing oil base paints. J. J. Basch, H. Frohwitter, R. B. Potter, R. S. Stebbins, W. M. Bliss, T. M. Christley, H. P. Jacques, C. S. Anderson, J. S. Todd, J. A. Seybold, W. G. Boaeuf, H. L. Franks, D. H. Evans, J. M. Hite, W. F. Pizoli, R. C. Williams, B. T. Fortin, J. P. Melhado, J. J. Hayes, E. G. Wolff, L. B. Nerheim, F. W. Lovatt, J. W. Haines, R. J. Colvin.

Osborn Mfg. Co.

5401 Hamilton Avenue, Cleveland 14, Ohio

Tampico and fire wheels, brushes.

Park Chemical Company

8074 Military Avenue, Detroit 4, Mich.

No. 312—Park's Kold-Grip Polishing Wheel Cement, and No. 290 Blackening Salt which is used in the finishing industry in a water solution as a blackening agent for steel parts. F. L. Woodside, President; P. H. Kramer, Technical Director; A. A. Wadson, Vice-President; H. D. Kitchen, Secretary-Treasurer; R. N. Lynch, Sales Manager; C. R. Foreman, Metallurgist; A. A. Aponick, Representative; T. J. Clark, Representative; R. Habberstein, Representative; M. J. Vandenberg, Representative; W. P. Woodside, Jr., Representative.

Parker Rust Proof Company

2177 East Milwaukee Avenue, Detroit 11, Mich.

No. 1909—Bonderite—mechanically bonds paint to metal; Bonderite—for cold forming of metals; Parco Compound—quality rust resistant coating; Parco Lubrite—treatment for coating metals to reduce wear; Parco Black—corrosion resistance and jet black color. M. G. Crandell, Eastern Regional Representative; E. G. Stone, Eastern Regional Representative; S. J. Colvin, Eastern Regional Manager; S. Rutkoff, Eastern Regional Representative; M. B. Roosa, Sales Manager; W. M. Sennett, Sales Department; H. J. McVey, Manager, New Product Division.

Partlow Corp.

2 Campion Road, New Hartford, N. Y.

No. 1577—Control equipment for solution level etc. E. W. Partlow, Jr., Pres., J. K. Clark, Chief Engineer, C. W. Pfhiger, Engineer, T. P. Owens, Secretary.

Phillips Mfg. Co.

3475 West Touhy Avenue, Chicago 45, Ill.

No. 635—Batch and Combination Model Vapor Degreasers; new working model of a Phillips Electric Monorail Conveyor. J. M. Bash, President; L. R. Anderson, Treasurer; H. J. Beierwaltes, Sales Manager; L. E. Plassmeyer, Senior Engineer, E. Crooker, Salesman; J. Dempsey, Salesman; R. Balton, Salesman; H. Burnham, Salesman; H. Lightner, Salesman; J. Hogue, Salesman; B. Rand, Salesman, E. C. Gillilan, Salesman.

Production Machine Co.

Greenfield, Mass.

No. 1540—Backstand Idler for use with abrasive belts. R. B. Robinson, Sales Manager; P. H. West, Asst. Sales Manager; R. A. Cole, Vice-President; C. F. Pickhardt, Treasurer; R. W. Schwartz, Sales Engineer; H. Sobieski, Sales Engineer.

Sparkler Mfg. Co.

Mundelein, Ill.

No. 1875—Model 8-18 Sparkler Rubberlined Filter; VR-17-6 Dual Disc Filter; Model SU-12-6 Sump Type Filter. Gordon C. Garland, J. C. Sharbaugh, C. J. Yeager, E. S. Anderson.

The Standard Electrical Tool Co.

2488-96 River Road, Cincinnati 4, Ohio

No. 908—Type S2C Speed Lathe for production deburring, and polishing of small parts will be in operation; Type 7RV Infinitely Variable Speed Buffer and Polisher and Abrasive Belt Backstand Idler. B. Holtmeier, Sales Representative; G. Liefeld, Sales Representative; J. Reid, Sales Representative; B. Ferguson, Sales Representative; B. Meade, Sales Representative; B. Dalton, Sales Representative; B. Ferguson, Sales Manager; J. Klopp, Treasurer; R. Huhn, Secretary; J. Falls, Chief Engineer.

Frederic B. Stevens

1800 - 18th Street, Detroit 16, Michigan

A large exhibit featuring a Stevens full automatic barrel plating and processing machine in constant operation. 30, 45 and 50 calibre shells will be passed through the various phosphating cycles. Carl B. Anderson, Advertising Manager.

Topper Equipment Co.

120 Central Ave., Clark Township (Rahway), N. J.

No. 1351—Standard vapor degreasing equipment. Melville Morris, President; Kenneth Hirtle, Chief Engineer; Maurice Gradman, Sales Engineer; Benjamin Manelis, Sales Engineer; Charles Curran, Sales Engineer; Geo. Angrave, Sales Engineer; Geo. Angrave, Jr., Sales Engineer.

Torit Mfg. Company

292 Walnut Street, St. Paul 2, Minn.

No. 1881—Unit type dust collectors, for grinders, polishing machines, woodworking applications. Stanley Pollnow, Assistant Sales Manager; W. O. Kellogg, District Representative; J. O. Achenbach, Associate Representative; R. C. Gray, Associate Representative.

Turco Products, Inc.

6135 S. Central Avenue, Los Angeles 1, Calif.

No. 1028—A group of five new Turcoating materials which deposit phosphate coatings on metal surfaces to improve adhesion of paint or other organic finishes. A. Simbro, District Manager; T. Few Brown, District Manager; Vernon Bragg, Assistant District Manager; J. J. Hart, Metal Processing Division Manager; G. Rice, Process Engineer; L. Nelson, Dy/Chek Coordinator; C. F. Devine, Public Relations.

Udylite Corporation

1651 E. Grand Blvd., Detroit 11, Mich.

No. 220—A Udylite automatic load and unload conveyor in operation and a Junior Full Automatic for zinc plating in operation. This large unit which also contains a washer and dryer will fill a space 38½ feet by 13½ feet and is capable of producing 100 racks per hour. John V. Davis, Chief Engineer will be available along with a staff of Udylite engineers.

Chromium-and-Glass High-Temperature Coatings for Molybdenum

BECAUSE of its high melting point (4750°F.), molybdenum offers possibilities for use in aircraft jet engines. If molybdenum is to be used at jet-engine temperatures, however, it must be protected from rapid oxidation.

The National Bureau of Standards has recently conducted a study of protective coatings for molybdenum composed of chromium and frit (glass). Results indicate that such coatings greatly extend the useful life of molybdenum at high temperatures, giving better protection than either chromium or ceramic coatings alone. Various chromium-frit coatings were bonded to molybdenum specimens, then subjected to oxidation tests under tension in the range 1500° to 1800°F. and to flame tests in the range 2000° to 3000°F. At temperatures of 1500° to 1800°F. the coated specimens lasted for 1000 to 3000 hours. At 2800°F., with no applied load, protection for as much as 7 hours was attained, enough to be valuable for some applications. The investigation was conducted by D. G. Moore and associates of the NBS enameled metals laboratory, under the sponsorship of the National Advisory Committee for Aeronautics.[1]

The present NBS study is one phase of a continuing program for development of ceramic protective coatings for metals and alloys. This NACA-sponsored program has resulted in several successful NBS coating formulations that are now in regular commercial production.

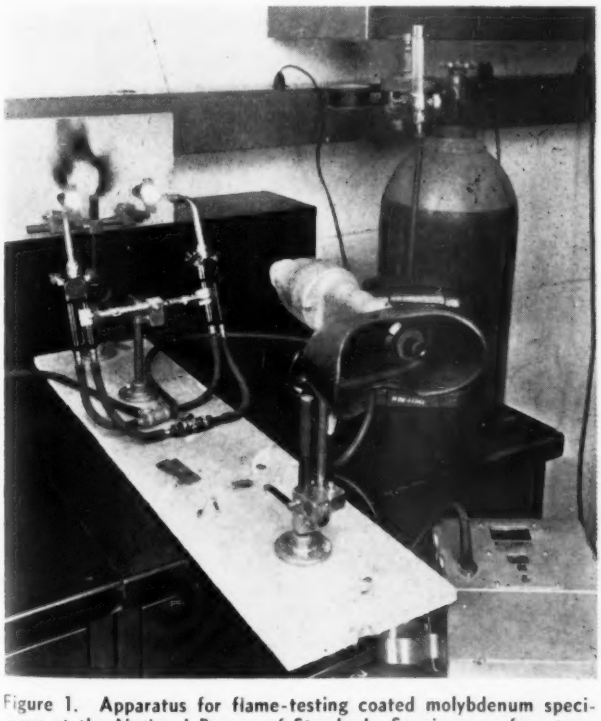


Figure 1. Apparatus for flame-testing coated molybdenum specimens at the National Bureau of Standards. Specimen surface temperatures, which ranged from 2000° to 3000°F., were observed by means of an optical pyrometer (right of center) Chromium-frit coatings were found to add substantially to the life of the molybdenum.

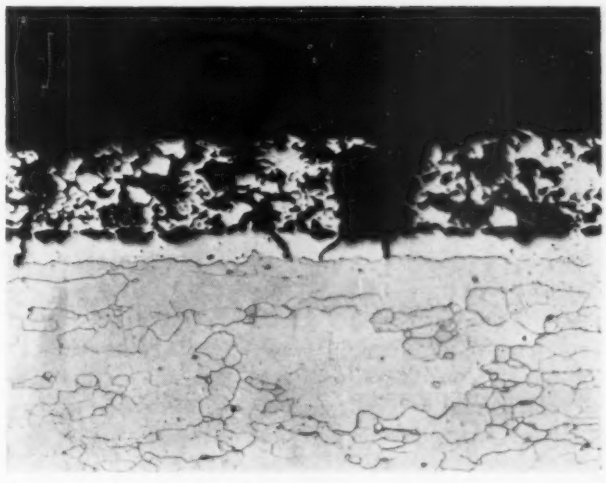


Figure 2. Photomicrograph of molybdenum specimen coated with glass seal-coat M-13 on top of chromium-frit coating M-39. The specimen was subjected to thermal shock for 25 cycles from 1800°F. prior to sectioning. The glass seal-coat apparently tended to seal thermal-shock cracks that developed in the base coat. Top (dark gray) layer: plastic mount. Second (narrow black) layer: glass sealcoat. Third (variegated grey-and-white) layer: chromium-frit coating. Fourth (narrow white) layer: diffusion layer. Bottom (near-white) layer: molybdenum. (X150, etched in nitric acid.)

In this new study, molybdenum specimens were first coated with one of several powdered chromium-bearing base coats, which in some cases also contained some frit (glass). After firing of the base coat, in either a hydrogen or an argon atmosphere, a ceramic seal-coat containing no chromium was applied to some of the specimens. Test results indicate that the most durable coatings resulted from application of a glass-free chromium base coat, followed by a glass seal coat. Addition of a third coat, consisting of lower-melting glass, resulted in a coating showing the highest durability of all those investigated.

Microscopic examination of sections shows that the chromium of the base coat has a somewhat porous structure, formed by the diffusion-welding of the chromium particles to each other and to the molybdenum base. The glass is subsequently absorbed into this structure during the firing of the seal coat. Although thermal strain and rapid creep tend to cause cracking of the coatings, adhesion is excellent and the glassy layer tends to reseal the fissures, so that cracking does not result in rapid failure.

[1]This NBS study is reported in detail in "Study of Chromium-Frit-Type Coatings for High-Temperature Protection of Molybdenum," by D. G. Moore, L. H. Bolz, J. W. Pitts, and W. N. Harrison, NACA Technical Note 2422 (July 1951).

The magnesium skin components of this Consolidated Vultee airplane were attractively finished so as to prevent corrosion with bake-on enamels.

Finishing Magnesium

By John Starr

ALTHOUGH magnesium and its alloys are relatively inert when exposed to ordinary atmospheric conditions, experience in the aircraft industry has proved that products comprising such materials must be finished for functional as well as decorative purposes because:

(a) Contact with other materials such as steel, copper, brass, and even wood can cause magnesium parts to corrode with exceptional rapidity.

(b) Particles of numerous types of foreign matter can form galvanic couples with magnesium, causing the latter to deteriorate.

(c) Stressed magnesium parts have a peculiar tendency to corrode in the presence of moisture and other media to which the same parts would be inert in an unstressed condition.

Where magnesium parts or materials must be stored for a considerable length of time, adequate corrosion resistance has been attained simply by giving the product surfaces a brush, dip, or spray coating of 600 W mineral oil thinned with kerosene. However, this necessitated careful cleaning or degreasing and the application of other coatings prior to use of the magnesium parts.

Particular care is exercised in preparing magnesium surfaces for finishing operations because surface contaminants, in addition to preventing the satisfactory bonding of coating materials, can result in a finish which will not prevent corrosion. Such preparations usually involve:

(1) The removal of oily matter by washing or vapor degreasing magnesium surfaces with chlorinated solvents, petroleum spirits, alcohol, lacquer thinners, or emulsion cleaners.

(2) The pickling of magnesium parts with chromic or sulfuric acid solutions so as to remove oxides, forming lubricants, old chemical finishes, etc. Sulfuric solutions are preferred if the parts have been sand or shot blasted.

(3) The mechanical removal of heavy oxide or dirt, if necessary, by wire brushing, sanding, shot or grit blasting, etc.

(4) The use of an alkaline cleaning solution with a pH value above 11. This normally follows the use of

Magnesium stampings are chemically cleaned and galvanically anodized with equipment of the type shown here at Lockheed Aircraft Corp.

A Douglas Aircraft worker sand-blasts magnesium coatings which will soon be ready for finishing operations.

one or more of the above cleaning techniques, because an alkaline solution will remove the residue of previous chemical treatments. A typical alkaline solution, which can be used either as a soak or electrolytic cleaner for magnesium, comprises 4 ounces of trisodium phosphate, 4 ounces of sodium carbonate, and 1/10 ounce of soap per gallon of water.

Chemical Treatments

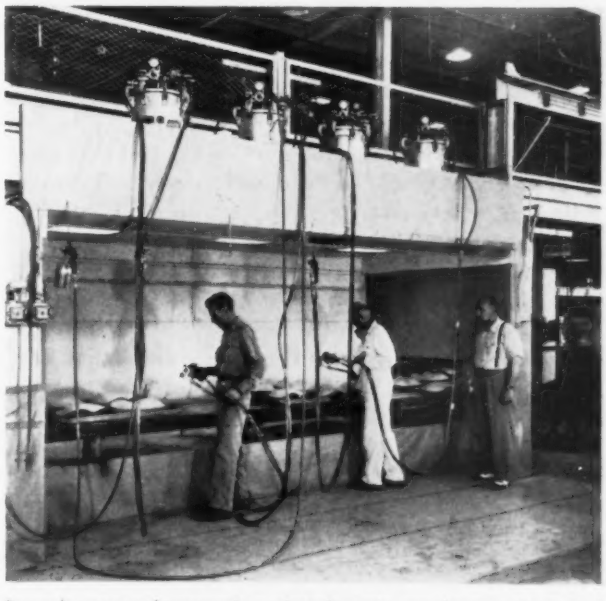
Protective chemical treatments are used to prevent damage to magnesium products if they must be handled to any extent prior to the application of finish coatings; also, for certain decorative finish effects and to facilitate the adhesion of organic coating materials. The purpose of these treatments is to build up a passive layer on magnesium surfaces in each different circumstance.

Where magnesium materials or parts must be shipped before they are finished, the passive layer is chemically produced at room temperature with a solution comprising 1.5 lbs. sodium dichromate and 1.5 pints of nitric acid per gallon of water. Materials are immersed in the solution for a maximum period of two minutes, drained for about 5 seconds, rinsed in cold running water, and dipped in hot water to facilitate drying. The color, luster and etch produced by this treatment varies in accordance with the compositions of different magnesium alloys and the age of the solution. Results of the treatment are considered satisfactory if the materials have a matte, gray to yellow-red, iridescent hue and a pebbled etch. Brown, non-adherent, powdery coatings are attained if parts are processed with exhausted or inadequate solutions or if the parts are suspended too long in open air before they are rinsed. Combustible powdery-gray coatings are sometimes encountered in processing castings; they can be prevented by adding two ounces of an agent such as ammonium acid fluoride to the processing solution, or by heating the solution to 120°F. and reducing the treatment time to about 12 seconds.

If magnesium parts should have maximum resistance to corrosive media such as salt water, the preferred chemical treatment involves the use of an aqueous solution containing 15 to 20% hydrofluoric acid at room temperature. Parts are immersed in this solution for about 5 minutes, rinsed in cold running water, and then boiled for at least 45 minutes in an aqueous solution containing 10 to 15% sodium dichromate. Next, the parts receive a final cold water rinse and a hot water dip to facilitate drying. When dry, the parts should have a dark brown to black color. Other colors and loose powdery deposits indicate processing deficiencies due to improperly cleaned parts, weak processing solutions, or improper rinsing.

When it is necessary to avoid dimensional changes in chemically treating magnesium parts, a galvanic anodize treatment is believed to be best. It consists first of immersing the parts for at least 30 minutes in a solution comprising 4 ounces ammonium sulfate, 4 ounces sodium dichromate and 1/3 fluid ounce ammonium hydroxide per gallon of water at a temperature of 120° to 140°F. A steel tank usually serves as the cathode during this interval, and the magnesium parts are electrically connected with the tank. At least 70 ampere-minutes per square foot of anode area are required to secure a uniform coating — which is normally black, if it is properly applied. Gray, non-uniform coatings are obtained if parts have been improperly cleaned or if solutions are depleted. Parts are rinsed in cold and hot water, then dried prior to further processing.

Magnesium parts requiring maximum abrasion resistance are given a caustic pressure treatment. This consists of soaking the parts for 5 minutes in a caustic solution under 225 psi pressure in an autoclave, after which the parts are rinsed and given a hot water dip.



Properly prepared magnesium aircraft parts can be organic coated with conventional finishing facilities, as demonstrated here in the North American aircraft plant.

This causes the magnesium to assume an attractive gray or bronze color as a rule, although organic dyes can be incorporated in the caustic solution if other color effects are desired.

Electrochemical techniques are normally preferred where magnesium surfaces should be simultaneously protected and decorated, since many brilliantly-colored coatings can thus be applied. A typical process in this category consists of treating a magnesium part as an anode in an aqueous bath containing lithium hydroxide and diethylene glycol. A current density of 10 to 20 amperes per square foot and a potential varying from 3 to 8 volts is used for a period of 15 to 30 minutes at a temperature of 160° to 195°F. The coating thus produced has a neutral hue, but it can be dyed by boiling the part in a solution containing an organic dye.

Electroplating is the preferred method of providing non-tarnishing metal finishes for magnesium parts used within modern airplanes. The parts are first nickel-plated, then they may either be buffed for a finished luster or top-plated with other metals — usually chromium, cadmium, or zinc. Prior to plating, the parts are cleaned as heretofore noted and double-pickled — first, in a chromic and nitric acid bath and, second, in a hydrofluoric and nitric acid bath. The electroplating solution is usually a nickel fluoborate bath.

Where it is desirable to retain the natural luster of magnesium, chemically-clean parts are merely polished and lacquered. Rough polishing requires the use of 60 to 100 grit abrasive, a felt or canvas type wheel with a 6″ to 12″ diameter, at a speed of 3000 to 5000 fpm. Medium polishing is done with a 100 to 200 grit abrasive (and a grease stick, if desired) on a set-up cloth wheel with a 6″ to 12″ diameter at a speed of 4000 to 6000 fpm. Fine polishing involves the use of a dry abrasive compound on a loosely-sewed buff wheel with any of the aforementioned diameters at a speed of 3500 to 5000 fpm. Straight buffing and coloring operations respectively necessitate the use of tripoli and dry lime abrasives, loosely-sewed buff wheels with 10″ to 14″ diameters or Canton flannel wheels with 12″ to 16″ diameters, at speeds of 6000 to 12,000 fpm — minimum pressures being desirable for the brightest lusters.

Organic Coatings

Many standard types of organic coatings can be satisfactorily applied to magnesium surfaces, if the latter are properly cleaned and chemically treated. However, the best organic coating in any given circumstance depends on the operating conditions a product or part must withstand.

Low chloride and low sulfate, zinc-yellow primers are usually preferred because they can be strongly bonded to chemically-treated magnesium surfaces and will provide a satisfactory base for finish coatings if applied in thickness of only 0.0005″. Surfacers are also utilized where finish coatings of maximum gloss are required, but not in other circumstances because resultant coating brittleness is rarely desirable. Lacquers are used as primers where related types of cellulosic finish coatings are specified.

Glyceryl-phthalate and phenol-formaldehyde types of spar varnish are regarded as excellent finish coatings for primed magnesium parts for seaplanes where extreme resistance to salt water corrosion is essential. Baking enamels are most often used on other aircraft parts which must withstand outdoor exposures, while cellulose-nitrate and non-specular lacquers are most frequently used on magnesium parts for indoor assemblies — that is, in areas where the parts will not be in constant contact with dissimilar metals. Hard and soft rubber coatings are often used to prevent the corrosion of magnesium due to the proximity of other materials.

In general, organic coatings are thinned and then applied and dried on magnesium surfaces with the same procedures and finishing equipment that would be utilized in providing the same coatings for other metal parts. One or two finish coats over a single coat of primer are normally sufficient for indoor applications, while one primer coating and two to five finish coatings are sufficient for outdoor applications.

Old or worn surfaces can usually be refinished after a simple sanding operation. Defective coatings are completely removed with chemical strippers or by sand blasting — never with open flames or heat — so that further defects can be avoided by completely reprocessing magnesium parts or assemblies.

The use of heat is never desirable in removing old coating materials from magnesium alloys, because thermal distortion and possibly a magnesium fire could then be anticipated. Sand blasting is preferred only where the magnesium parts have considerable cross-sectional thickness and there is no danger of altering critical dimensions.

EVAPORATION TECHNIQUE IS KEY TO ADHESION STUDIES

EVAPORATION techniques for the adhesion of electroplatings and solders to oxide-coated metals and glass have shown great progress at the Engineer Research and Development Laboratories, Fort Belvoir, Virginia.

Some metals are difficult to electroplate or solder due to poor adhesion to their natural hard tenacious oxide coatings. When these coatings are removed new oxides are immediately formed. Metals such as aluminum, chromium and titanium become coated with an oxide film even at room temperature in a vacuum at pressures less than 10^{-5} mm Hg. Hence, it is desirable to secure adhesion to these metals by a process which includes their oxides. Excellent adhesion to these oxides can be obtained by high vacuum evaporation techniques. Evaporated films of most metals that form hard adherent oxide coatings can be caused to adhere tenaciously to their own and to other oxides, including glass. Evaporated films of some other metals, particularly gold, silver and copper show poor adhesion to oxides. However, a metal of the latter group can be made to adhere tenaciously to a metal of the former group by high vacuum evaporation techniques. The vapors of the two metals can be deposited simultaneously in such a manner as to eliminate the oxide coating which normally hinders adhesion. Thus, to coat titanium with copper, titanium is first evaporated

(*Concluded on page 73*)

A Practical Evaluation of Metallic Coatings as Affecting Sensitivity to Stress-Corrosion Failure

By C. H. Hannon, *Metallurgical Engineer, Laboratory-Engineering Department, Transformer and Allied Products Division, General Electric Co., Pittsfield, Massachusetts*

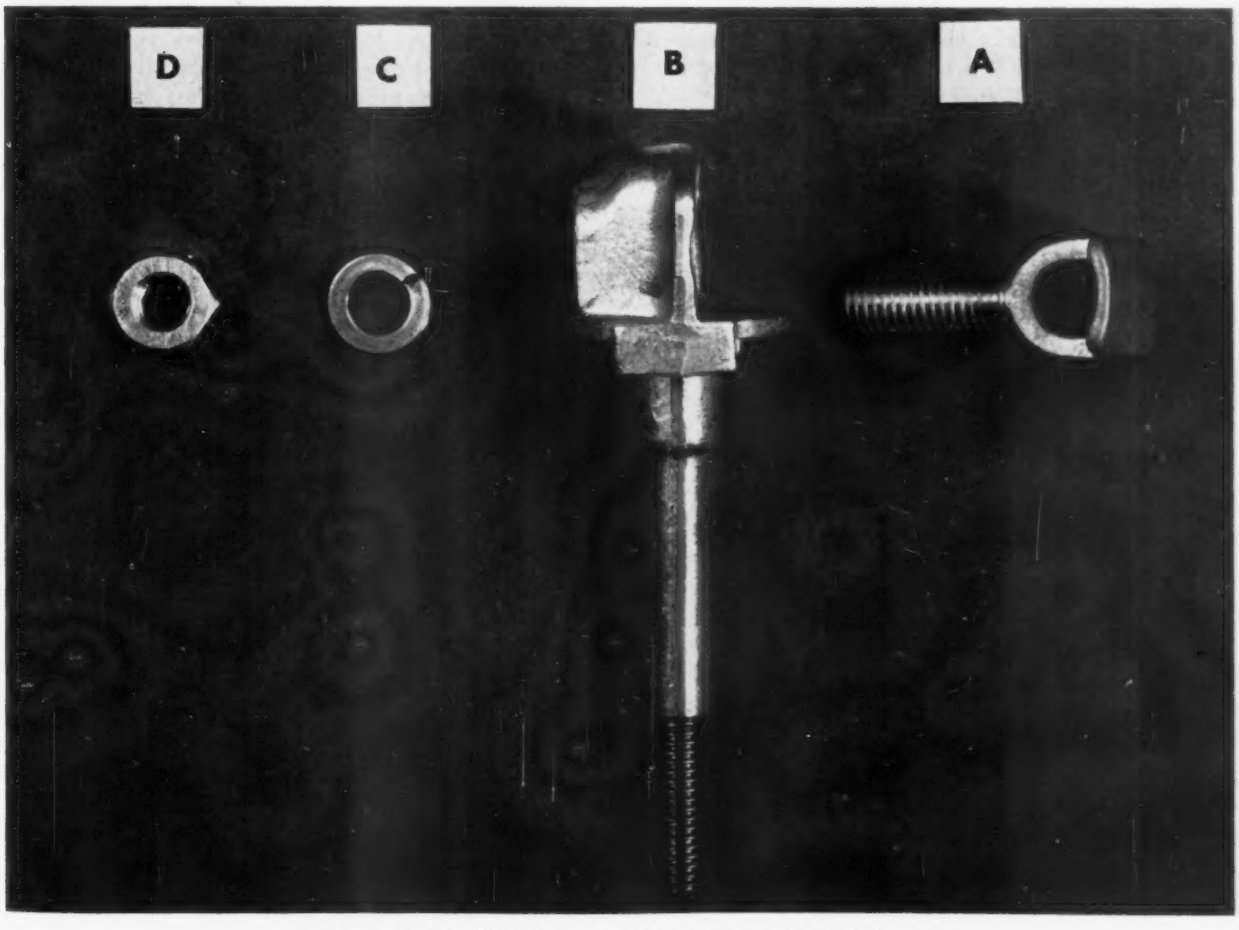
THE failure by breaking of mechanical structures subject to stress and corrosion is a common phenomenon. While originally recognized as a weakness of the copper-base alloys, experience has disclosed a similar characteristic in many other engineering alloys.

Of particular concern to General Electric Company engineers is the operational continuity of electrical apparatus and service. An illustration is the significance of proper design and application of distribution transformer terminal clamps. With a service background disclosing an occasional power transmission interruption because of broken electrical bushing terminal bolts, the project being reported attempted to evaluate the effect of metallic coatings on the bolt member.

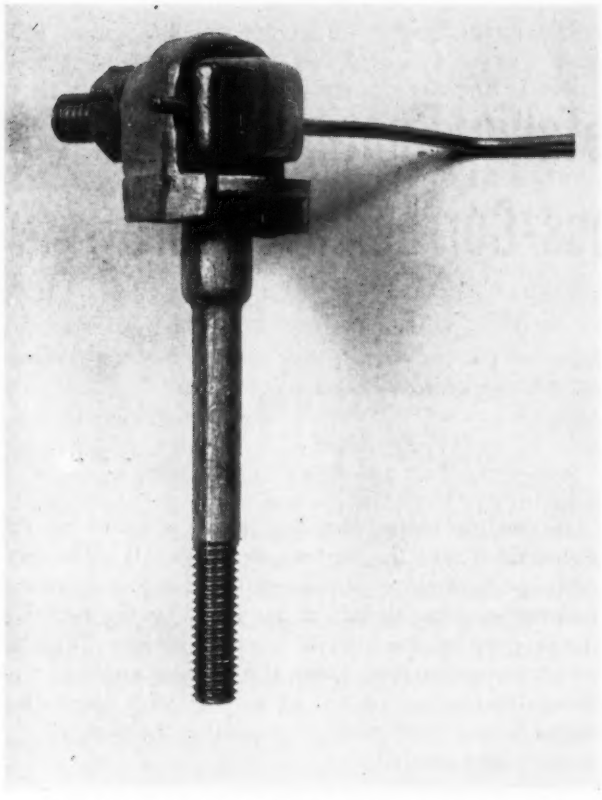
A sensible philosophy has been expressed by the statement, "Save the Surface and Save All." The concepts pertaining to stress-corrosion and mechanical failures resulting therefrom are based on the fact that the progress of attack starts from the surface. The idea was therefore suggested that, if a stressed article is rendered inactive to, or out of contact with, corroding media by the application of a coating, the part so protected might not fail.

Testing Program

Pressure terminal clamps vary considerably, but in basic design they all employ a bolt member which serves to bring two mating parts together in clamped



Component parts of distribution transformer pressure terminal clamp.



Assembled view of distribution transformer pressure clamp.

position on the transmission cable conductor. The tightening of the bolt transmits a unit stress varying with the design and bolt cross-section. It was important, therefore, to choose one test assembly so results would be comparable. Figure 1 shows the component parts of the assembly which consisted of a 3/8"-16 eyebolt (a), the terminal stud (b) which normally would be mounted through a porcelain insulating bushing, a lock washer (c), and a 3/8"-16 nut (d). A view of the composite assembly is shown in Figure 2.

The conditions of test imposed a fixed torque load of 230 in. lbs. on the eyebolts, using a solid cable 0.128" in diameter through the eye. The value of 230 in. lbs. has not been standardized in the trade but has been used as a criterion of acceptance by several electrical equipment manufacturers. This figure appeared to be

Table I (Mercurous Nitrate)

Specimen	*Coating*	*Result*
a_1, a_2, a_3	none	failed
b_1, b_2, b_3	nickel	"
c_1, c_2, c_3	copper + nickel + chromium	"
d_1, d_2, d_3	copper + nickel + tin (1)	passed
e_1, e_2, e_3	copper + tin (2)	"
f_1, f_2, f_3	nickel + tin (1)	"
g_1, g_2, g_3	tin (2)	"
h_1, h_2, h_3	tin (3)	failed
i_1, i_2, i_3	silver	"
j_1, j_2, j_3	copper + silver	"
k_1, k_2, k_3	cadmium	"

(1) Tin coating flowed
(2) " " as electroplated
(3) " " diffused at 700°C.

Table II (Ammonia)

Specimen	*Coating*	*Result*
a_1, a_2, a_3	none	failed
b_1, b_2, b_3	nickel	"
c_1, c_2, c_3	tin (1)	passed
d_1, d_2, d_3	tin (2)	failed
e_1, e_2, e_3	tin (3)	"
f_1, f_2, f_3	silver	"
g_1, g_2, g_3	cadmium	"

(1) Tin coating melted
(2) " " as electroplated
(3) " " diffused at 700°C.

in excess of the normal load likely to be manually applied using a customary 12" wrench.

A uniform procedure was followed, embracing machining of the eyebolts, choice of nuts to constant thread tolerance, precleaning and application of load to the assemblies by means of a calibrated torque wrench. A variable does exist in the test procedure, which is dependent on the friction developed between the assembled components, and this factor is admittedly related to the nature of the electroplated metal coatings. An interpretation of results may therefore be qualified by a minor error in the absolute stress on the eyebolt cross-section.

The majority of the evaluation tests were conducted by immersion in a mercurous nitrate solution prescribed in ASTM B-154-45, and supplementing tests were also carried out by exposing terminal assemblies to the atmosphere generated by a standard 28% reagent ammonium hydroxide solution contained in a suitable, closed glass receptacle. The duration of immersion in mercurous nitrate was for a constant time of 15 minutes, after which the eyebolts were examined for the existence of cracks. Either complete fracture or initial cracking was classified as failure, which invariably occurred in the yoke section. Those parts which were rated as having passed the test were observed to have maintained the imposed torque load. Because of the nonexistence of a standardized testing procedure using ammonia, the period of exposure was arbitrarily extended to eliminate all coatings except the one showing the longest period of resistance. The results are not indicative of a quantitative rating.

The eyebolts used in the investigation were hot-forged from one alloy, the composition of which was nominal 91% copper, 7% aluminum, and 2% silicon. Previous tests had established the fact that this alloy will fail in both a mercurous nitrate solution and in ammonia vapor, if critically stressed.

The metallic coatings applied were composite electroplates of copper + nickel + chromium, copper + nickel + tin, copper + silver, copper + tin, nickel + tin, and single electroplates of silver, cadmium, and tin. Each metallic element was electroplated to a thickness of approximately 0.0002". Special treatments of a tin electroplate are indicated by the suffix numbers (1) and (3) following Tables I and II. Three tests as a minimum were conducted for each coating, to establish a consistent behavior.

(Concluded on page 71)

Anodizing Aluminum With Sulfamic Acid

Comparison of Sulfuric, Oxalic and Sulfamic Acid Processes

Sakae Tajima, Yasuyuki Kimura and Toshiro Fukushima,

(Laboratory of Electrochemistry, Tokyo Metropolitan University and Chemistry Division, Metropolitan Industrial Research Institute, Tokyo)

Introduction

SULFAMIC acid, HSO_3NH_2, was extensively studied in Japan by E. Divers, T. Haga and J. Sakurai[1] about sixty years ago and many of its physical and chemical properties were made clear by them. However, industrial application of the acid was not developed as a practical process of synthesis had not been established. The industrial application started with the success of synthesis of Baumgarten[2] in Germany and E. I. du Pont de Nemours & Co.* by urea-oleum reaction. Recently the commercial production of the acid started in Japan by the method of NH_3-SO_3 reaction developed by Shogo Uchida (1942)[3] and Nitto Chemical Co.

Before our present research, the sulfamic acid process for anodizing aluminum was suggested by W. E. Gordon and M. E. Cupery[4] of du Pont and developed by Reynolds Metals Co.,[5] but its details are not known to us yet and, in the course of our research, Prof. R. Piontelli** of Politecnico di Milano, Italy, wrote to us of his Italian patent[6] concerning the sulfamic acid anodizing process.

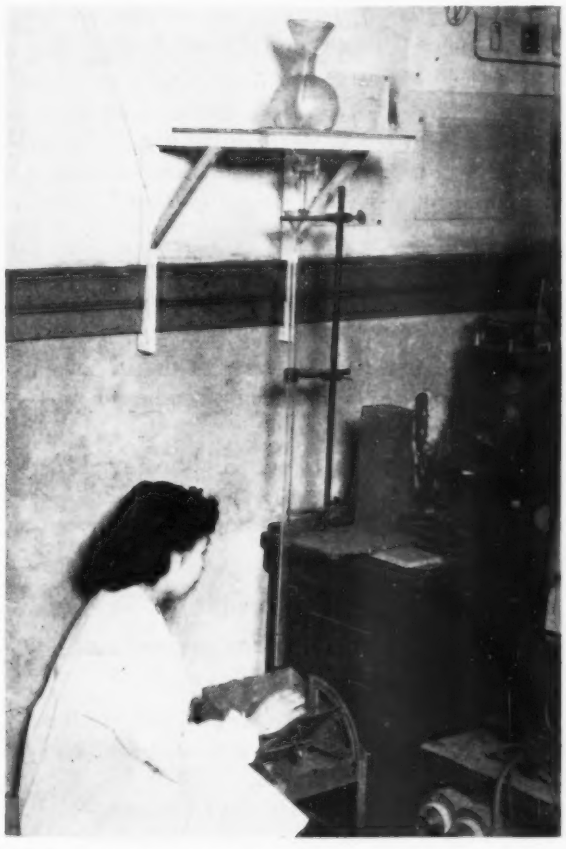


Photo 1. Measuring device for abrasion resistance of anodized films. Carborundum particles are falling upon the inclined surface of the specimen through glass tube.

In the present paper, the authors studied the process of anodizing with sulfamic acid and compared it with the sulfuric acid process (Alumilite) and oxalic acid process (Alumite)[7] and with steam-sealing[8] which had been developed by Kujirai, Ueki, Setoh and Miyata before the Eloxal process[9] was established in Germany.

Circuits, Pretreatment and Testing Methods

The principle of electrolysis employed for the present research was based on the circuit through which anodizing could be carried out independently in three different ways, that is, formation by d.c., single phase a.c. and superimposition of a.c. on d.c., — the circuit employed by Akira Miyata of the Scientific Research Institute, formerly the Institute of Physical and Chemical Research, Tokyo.

The conditions of anodizing are as follows:—

Electrolyte:	about 2 L. in a 4 L. beaker
Cathode:	carbon plate (surface area 1.4 dm^2)
Anode:	for d.c., Al plate 1.0 dm^2 (8 × 6 × 0.05 cm.)
	for a.c. or superimposition, 0.5 dm^2 Al plates (8× 3 × 0.05 cm.)
Electrode distance:	for d.c. 8 cm. (Al to Al)
	for a.c. 10 cm. (Al to Al)
	for superimposition 10 cm. (Al to Al), 7 cm. (Al to carbon plate)
Analysis of Al plate used:	Fe-0.40%, Si-0.24%, Cu-0.17%, Al balance.

Bath temperature was kept constant during electrolysis within the error range of ± 0.2°C. by cooling with a spiral coil or externally heating the beaker.

Electrolyte was agitated by air (velocity of air was 0.8-1.0 L./min.).

*E. I. du Pont de Nemours & Co., Inc., Expt. Lab., unpublished reports, 1936.

**Oct. 23, 1951.

Sulfamic acid used was "Industrial Grade" and the acids of various origins were mixed to secure uniform quality.

The acid concentrations are expressed by weight percent. Distilled water was used as solvent and solutions were prepared fresh for each experimental run to eliminate the effect of Al ion.

Fig. 1 shows the electrolytic circuit employed. A transformer with a terminal at the neutral point of the secondary coil was applied for superimposition. The field resistor of a shunt wound d.c. generator and an adjustable rheostat were used for the regulation of d.c. current and voltage and an auto-transformer and a sliding resistor were employed for a.c. regulation.

A special transformer designed to eliminate the d.c. magnetic flux and to add the a.c. magnetic flux, was used in order to measure a.c. current of the superimposing circuit. The pulsating part of generated d.c. was filtered.

Preliminary cleaning treatments of specimens were performed in the following way.

1. Dip for several seconds in warm alkaline solution (Na_2CO_3 — 30 g., Na_3PO_4-20 g. NaOH= 30 g. in 1 L. distilled water) with agitation.
2. Rinse.

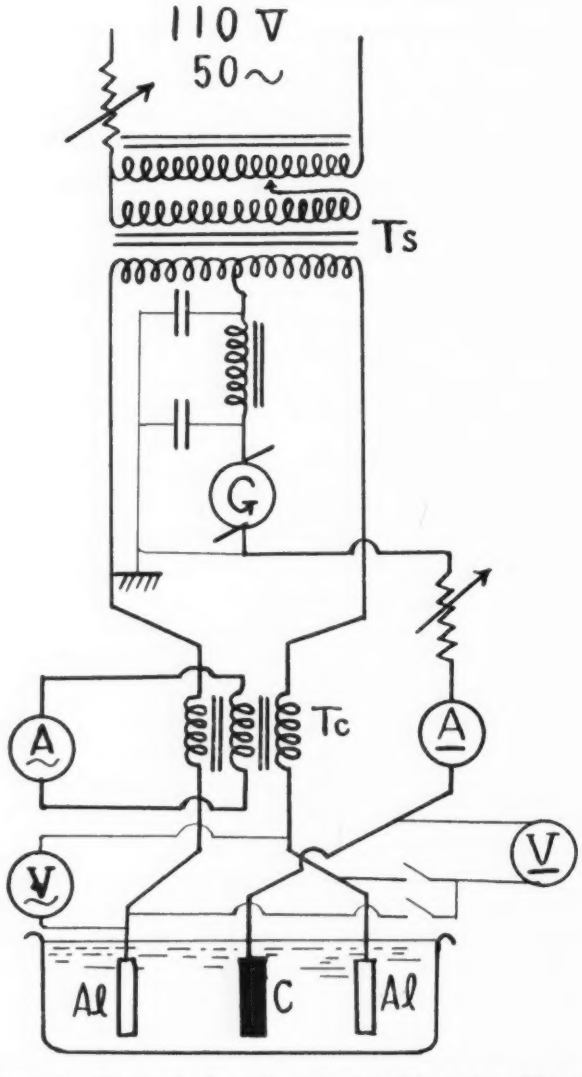


Figure 1. Electric circuit employed for anodizing in three different ways—d.c., a.c. and superimposition of a.c. on d.c.

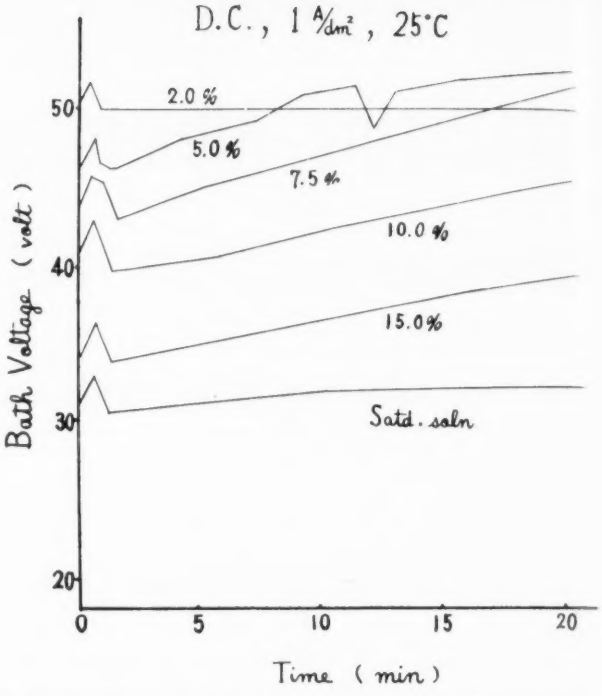


Figure 2. Change in bath voltage with anodizing time in various concentrations of sulfamic acid, d.c., 1 amp./dm.², 25°C.

3. Neutralize and clean in HNO_3 (Sp. gr. 1.17)
4. Rinse with distilled water.

The thickness, abrasion resistance and corrosion resistance of films were measured by the methods recommended in "Tests of Anodized Aluminum," Japanese Industrial Standard (JIS).

Thickness: direct measurement of the section of specimens with metallurgical microscope and micrometer eyepiece.

Abrasion Resistance: measurement of the time (seconds) required to wear off the films with carborundum particles (80 mesh) falling upon a specimen from 1000 mm. height (amount falling 320 g./min.). See photo 1.

Corrosion resistance: measurement of the time (seconds) required to remove the film with 10% NaOH solution at 35°C. dropped on a specimen.

Anodized color was inspected with the naked eye under daylight in a room facing south and was compared with the standard color.

Dyeing test was carried out with three popular dyes, viz. Direct Black, Lionol Blue and Roccellin Acid, by dipping an anodized specimen in their 1% solutions at 70°C. for 1 min.

Experimental

(A) Effect of Concentration of Sulfamic Acid

(a) Direct Current Process:

Electrolyte: 2.0, 5.0, 7.5, 10.0, 15.0 wt. % HSO_3NH_2 and saturated solution
Temperature: 25°C.
Anode Current Density: 1.0 amp./dm.²
Time: 20 min.

The change of bath voltage with anodizing time in each concentration is shown in Fig. 2.

Bath voltage rose steeply to a certain degree in 30 to 50 seconds and rapidly dropped, then showed a gradual increase. Similar phenomena to this voltage drop at the initial stage had been observed and precisely studied by S. Setoh and A. Miyata[10] with the oxalic acid anodizing process.

The phenomena are considered to be caused by the decrease of the resistance of the film (at a certain point) after the steep increase where dense film had been formed.

With a 2% solution, the voltage held constant after the initial voltage drop and the anode was dissolved into the solution with simultaneous formation of the film.

With a 5% solution, pitting occurred after 7 minutes anodizing, at the center of the side of the specimen opposite to cathode — the area of the longest current path. After 11 minutes, the voltage suddenly dropped and corrosion also occurred at the edge of the specimen — this resulted in low current efficiency. Therefore, it appears that low concentration baths were not favorable for the perfect formation of the film on account of anodic dissolution as described later.

With solutions over 7.5%, a gradual increase of voltage was observed after the initial voltage drop. The more dilute the bath, the greater is the increase of voltage rise as shown in Fig. 3.

For example, with a saturated bath, the difference between voltage after the initial voltage drop and after 20 min. anodizing was 1.8 volts, while with the 7.5% solution, it was 8.6 volts.

Results of the test of specimens are shown in Fig. 4. With 2.0 and 5.0% solutions, very inferior properties were shown. In these cases, the efficiency of oxide formation was low. For example, with the 2.0% solution, the thickness of film was only 1.7 microns. So it is considered that with low concentration baths, anodic dissolution and oxidation took place at the same time.

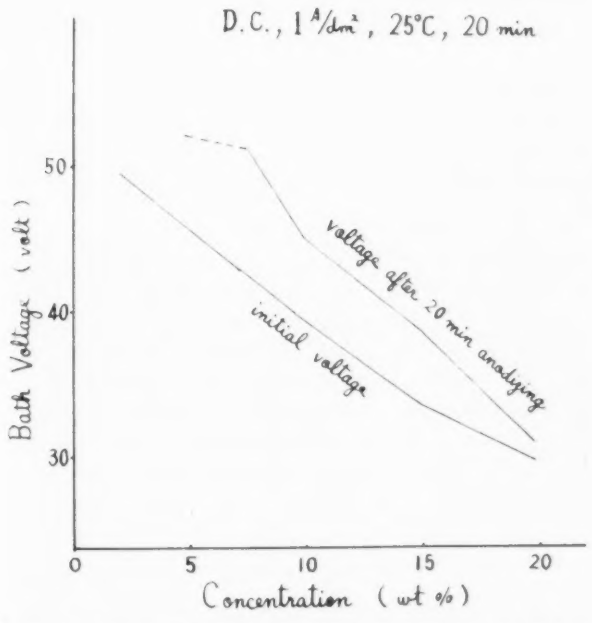


Figure 3. Change of initial and final (after 20 min. anodizing) voltage with concentration of sulfamic acid, d.c., 1 amp./dm.², 25°C.

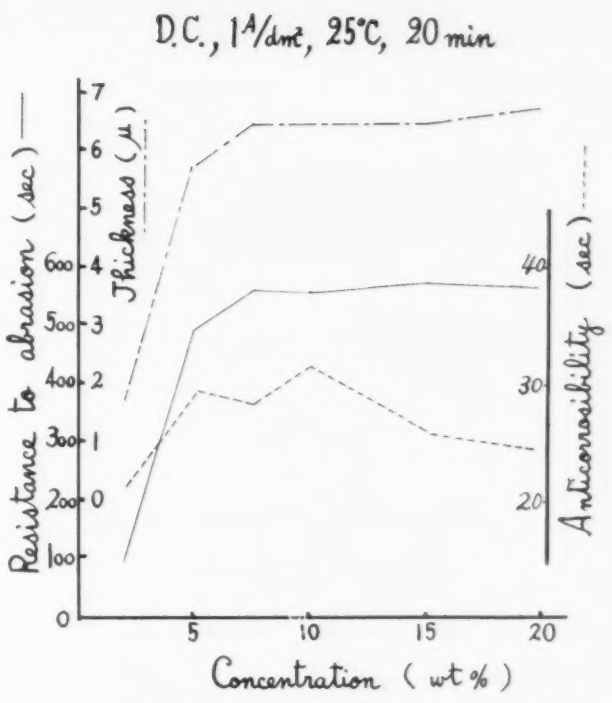


Figure 4. Properties of films anodized in various concentrations of sulfamic acid, d.c., 1 amp./dm.², 25°C., 20 min.

With solutions over 7.5% which made possible perfect formation of the film, no remarkable variations of thickness and abrasion resistance with concentration were observed and only the corrosion resistance of films formed in 15% and saturated solutions were slightly inferior to the other films.

Absorption of dye was greatest for films produced in the 7.5% solution (light brownish gray, Hue 7, Luminosity 17-18, Saturation 1). Saturated solutions produced nearly colorless films. Affinity for dyes was not obtainable satisfactorily with any solution at such a low temperature (25°C.) and short anodizing time.

(b) Alternating Current Process:

Electrolyte: 2.0, 7.5 and 15% HSO_3NH_2
Temperature: 25°C.
Current Density: 1.0 amp./dm.²
Time: 40 min.

Quite erratic fluctuations of bath voltage were observed with all the above three baths. Rough and easily-peeled films were formed and the surfaces were covered with white powdery products. Films were so porous that water, dropped on a dried film, spread rapidly and widely.

The results of film tests are shown in Table 1.

Table 1. Effect of Bath Concentration on Properties of Films Anodized with Alternating Current

Bath Conc.	*Abrasion Resistance*	*Corrosion Resistance*	*Spread of water drop on film*
15% wt.	40 sec.	13 sec.	small
7.5 "	30 "	6* "	medium
2.0 "	10 "	3* "	large

*Approximate (exact measurement could not be made as NaOH drop spread rapidly on surface of specimens).

Comparatively good films were obtained with the

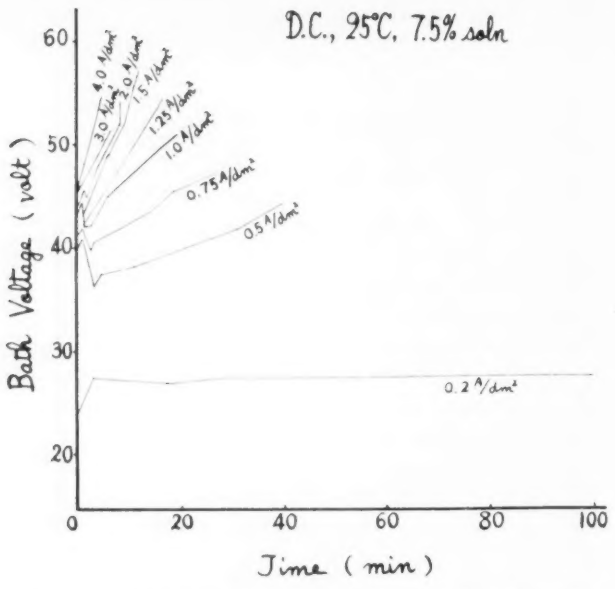


Figure 5. Change in bath voltage with anodizing time under various current densities, d.c., 7.5% sulfamic acid, 25°C.

15% solution, but the films were generally inferior to those formed with direct current. Even with a 2.0% solution, no local dissolution phenomena of the anode took place by a.c. formation.

(B) Effect of Current Density

(a) Direct Current Process:

Electrolyte: 7.5% HSO_3NH_2
Temperature: 25°C.
Total Current: 20.0 amp. minutes/dm.² (constant)
Current Density: 0.2, 0.5, 0.75, 1.0, 1.25, 1.5, 2.0, 3.0, 4.0 amp./dm.²
Resulting Time: 100, 40, 26.6, 20, 15.2, 13.3, 10, 6.6, 5 min. respectively.

The changes of bath voltage with anodizing time at various current densities are shown in Fig. 5.

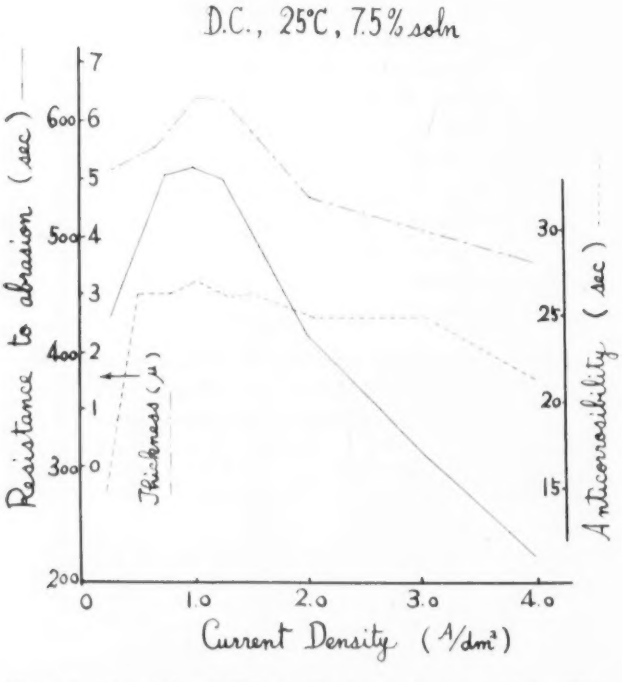


Figure 6. Properties of films anodized at various current densities, d.c., 7.5% sulfamic acid, 25°C.

With any current densities, the voltage drop at the initial stage of electrolysis occurred. The higher the current density, the larger was the increase in bath voltage. With current densities higher than 1.5 amp./dm.², local dissolution of anodes took place and perfect and continuous films were not obtained. Hence, at 25°C., a current density below 1.25 amp./dm.² is preferable. The results of the test of anodized films are shown in Fig. 6.

From Fig. 6, it is obvious that the optimum current density is 1.0 amp./dm.² and long anodizing with low current density such as 0.2 or 0.5 amp./dm.² for 100 or 40 min. is not suitable in this case.

It was found that anodizing at 1.0 amp./dm.² for 20 min. was much more satisfactory than anodizing at 0.2 amp./dm.² for 100 min., as shown by film tests, 19% greater thickness, 23% better abrasion resistance and 50% better corrosion resistance.

Absorption of the dyes was highest with 1.0 amp./dm.². Satisfactory affinity for dyes was not obtained at any current density at 25°C.

(b) Alternating Current Process:

Electrolyte: 7.5% HSO_3NH_2
Temperature: 25°C.
Total Current: 20.0 amp. minutes/dm.² (constant)
Current Density: 0.2, 0.5, 1.0, 2.0, 4.0 amp./dm.²
Resulting Time: 100, 40, 20, 10, 5 min. respectively.

The changes in bath voltage with anodizing time at various current densities are shown in Fig. 7.

With 1.0 and 2.0 amp./dm.² (resulting anodizing time 20 and 10 min. respectively), the bath voltage showed no regular increase with anodizing time, and frequent fluctuations were observed in voltage and current. It is supposed that formation and destruction of films were alternately occurring. The film thereby formed was very rough and many dirty spots were produced on the surface.

Abrasion and corrosion resistance of the films

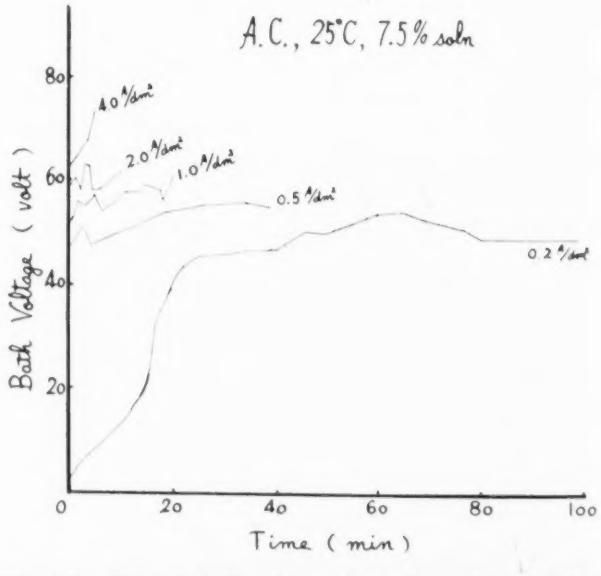


Figure 7. Change in bath voltage with anodizing time at various current densities, d.c., 7.5% sulfamic acid, 25°C.

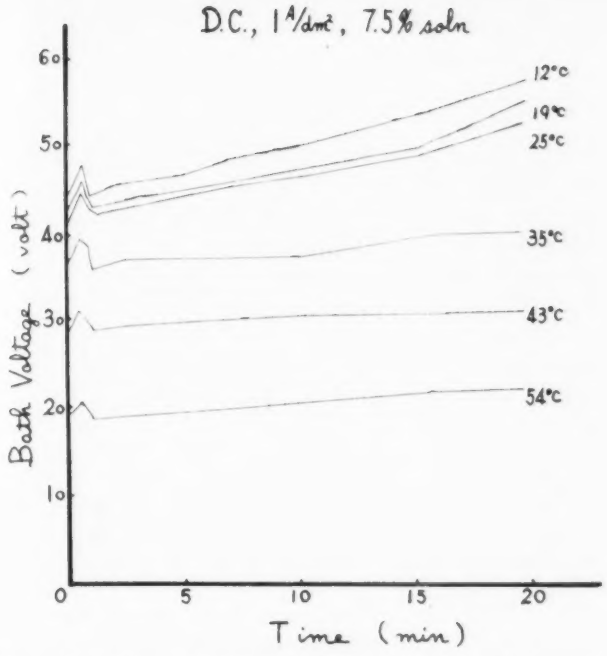


Figure 8. Change in bath voltage with anodizing time at various temperatures, d.c., 7.5% sulfamic acid, 1 amp./dm.^{2}.

formed under the above conditions (1.0 and 2.0 amp./dm.^{2}) were 12 and 2 seconds respectively.

With 0.5 and 0.2 amp./dm.^{2}, the voltage regularly increased and the appearance of the films was comparatively good but abrasion resistance were 26 and 10 sec. and corrosion resistance were 12 and 6 sec. respectively, showing bad quality. Moreover, films were easily scaled off by bending.

With 4.0 amp./dm.^{2}, the voltage regularly increased for 5 min. and abrasion resistance was 212 sec. and corrosion resistance was 18 sec. showing fairly good quality but the surface was very rough.

Affinity for dyes was the same but the finish was not satisfactory because the film itself was too rough.

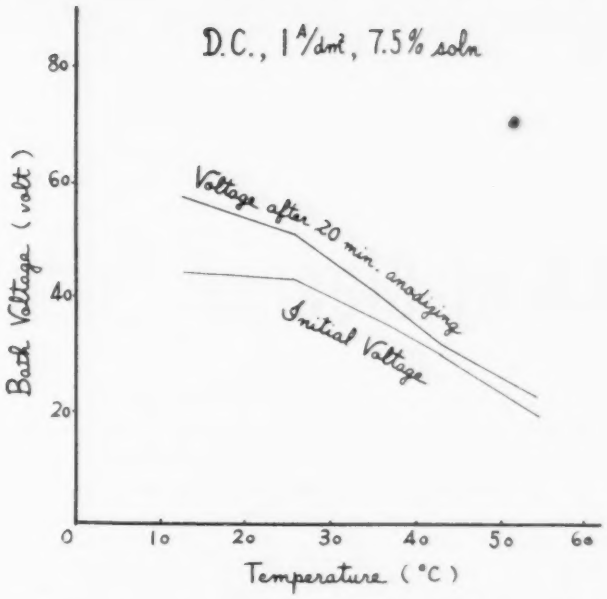


Figure 9. Change in initial and final (after 20 min. anodizing) voltage with temperature, d.c., 7.5% sulfamic acid, 1 amp./dm.^{2}.

(C) Effect of Bath Temperature

(a) Direct Current Process:

Electrolyte: 7.5% HSO_3NH_2.
Temperature: 12, 19, 25, 35, 43, 54°C.
Current Density: 1.0 amp./dm.^{2}
Time: 20 min.

The changes in bath voltage with anodizing time are shown in Fig. 8.

The higher the temperature, the lower was the bath voltage, and the degree of increase in bath voltage was greater at lower temperature. This is indicated in Fig. 9. Since the edge of the anode was dissolved slightly at 12°C., a temperature above 12°C. is profitable for satisfactory film formation.

(To be continued next month)

PRACTICAL EVALUATION

(Concluded from page 66)

Test Data

Table I gives the results of the mercurous nitrate tests and Table II, the results in ammonia. Each specimen was assembled under the exact conditions prescribed in the previous section under Testing Program.

Discussion of Results

It is evident from the data in Table I that a coating of tin has beneficially retarded the susceptibility to cracking in a mercurous nitrate solution for the duration of exposure. The diffusion of tin at 700°C. with the formation of a copper-tin alloy did not provide protection against attack. It appears that the essential element is tin, either as electrodeposited or in the state of a flowed coating, and that its effectiveness under conditions of test is solely chemical in nature. A reaction between the tin and the mercurous nitrate solution, which is sacrificial so far as the tin is concerned, progresses during immersion and serves to weaken the activity of the mercury salt solution. As long as metallic tin remains, a spongelike product continues to form, which prevents deposition of mercury on the base metal surface. Tin, in this respect, behaves differently than the elements silver and cadmium which, by forming adherent and wetting amalgams, provide the means whereby the mercury may reach the underlying base metal. The coatings of nickel and chromium appear to be pervious to the mercury salt solution, and the under coat of copper provides no barrier.

More pertinent data appear in Table II, because the tests in ammonia are considered more significant in rating the effectiveness of various coatings, insofar as atmospheric stress-corrosion failures are concerned. While fewer tests were made in ammonia, it is convincingly shown that tin, as electroplated, does not provide immunity to failure. The fact that a beneficial effect is realized with a flowed tin coating suggests that a chemically inactive and impervious coating is the logical means of preventing stress-corrosion failures. It is also pertinent to observe that the immunity provided by tin, in the mercurous nitrate test, is not truly significant insofar as service performance of electroplated parts is concerned. It might be assumed that a noble metallic coating would be more desirable from the point of view of permanency of coating, but the obvious conclusion is that continuity of film or absence of porosity is ultimately most important.

Alkali Cleaner "Life"

By H. K. Hunt, Ch.E., *L. H. Butcher Company, Los Angeles, Cal.*

ONE of the most elusive and puzzling angles of the metal cleaning art is the question of useful "life." Of course, the first requirement of any metal cleaner is that it render the surface both chemically and physically clean. The next question that comes to the plant superintendent's mind is, "How long will it continue to perform satisfactorily before it must be dumped?" It is this latter phase of the problem that will be discussed in this writing.

The variable factors involved may be listed as follows:

1. Saponification
2. Conversion to carbonates
3. Dirt load
4. Drag-out
5. Volume of solution
6. Adsorption

It will be noted that the changes occurring in the cleaning solution fall into two main categories; viz. chemical changes and physical changes. The first two, i.e., saponification and carbonation, would be classed as chemical effects, while the last four are physical effects.

Saponification

All metal cleaner operators are familiar with this reaction whether they are processing the surface for subsequent plating, printing, galvanizing or other treatments. Any saponifiable or soap forming fats or oils present on the work will combine chemically with the alkalies in the bath to form soaps. The most active alkali present is the caustic soda and this material tends to react with the fatty acids and glycerides preferentially. The saponification reaction is actually a neutralization of an acid and a base with the formation of a salt, which in this case is the soap. The result is a partial loss of free alkali and a gain in the solution of a surface active agent, such as sodium stearate, sodium oleate, sodium rosinate, or some other soap depending on the saponifying material.

Let us balance the profit and loss sheet resulting from this chemical reaction. The loss in free caustic reduces the electrical conductivity which in turn reduces the gas evolution at any given voltage. A further effect of the reduction in free caustic, which particularly applies to anodic cleaning at high current densities, is the danger of anodic polarization. This is caused by insufficient sodium ions present to take up the acid radicals, such as silicates, phosphates, rosinates, etc., formed at the surface of the work. We have already mentioned the gain in surface active agent which will promote cleaning except, of course, if the soap content builds up too high it will cause gelatinous solutions and excessive foaming in electro-cleaning baths. Saponification can cause a further problem in regions where hard water is used, due to the formation of insoluble calcium and magnesium soaps which deposit on the work as a curd and which are extremely difficult to wash off. This latter reaction does not effect the composition of the cleaner in itself, but deserves mention at this point by virtue of its formation in the saponification process.

Carbonation

This second chemical change is also a simple acid-base neutralization. In this case the weak acid is carbonic acid gas (carbon dioxide), present in the air, which combines with the stronger alkalies, such as caustic soda, sodium silicates, and sodium phosphates to form sodium carbonate. Here again the free caustic soda is the preferential victim of the reaction process, although silicates and phosphates are also subject to conversion to carbonates. If an alkaline cleaner is allowed to stand for a prolonged period of time it will slowly absorb carbon dioxide and will eventually become excessively high in sodium carbonate content. This is true even though the solution is not used to clean dirty work. It is seen then that, after long periods of shut-down, one cannot expect the solution to be in the same condition as it was prior to the shut-down.

In drawing a profit and loss balance, here it may be said that there is no profit but all loss. While it is true that sodium carbonate in itself will exert some cleaning action, it is relatively inefficient. The electrical resistivity of sodium carbonate solution is four times that of caustic soda and here again there is a loss of current carrying capacity at a given voltage. Furthermore, sodium carbonate is a relatively poor emulsifier and dispersing agent. Consequently, this property will suffer proportionally to the carbonation occurring in the solution. It is thus seen that this deterioration results in a loss in electrical conductivity, emulsifiability and dispersability.

Dirt Load

This factor is a physical build-up resulting from the unsaponifiable oils and greases and a wide variety of solid particle dirt incidental to buffing, handling and storage operations prior to the cleaning. The dirt load probably limts the useful cleaner life before any of the other features reach their permissible limits. It is strictly a function of the amount and condition of the work put through the solution. No one can predict accurately how long the bath may be operated prior to discarding it and making a new one. A few remarks, however, may contribute towards a better understanding of

the effect of the dirt accumulation. As work is put through the cleaner solution, oils and greases are emulsified and distributed throughout the bath. Solid particles, such as abrasive grains, dust, dirt, metal chips, etc., either fall to the bottom if they are comparatively coarse particles or are suspended throughout the bath in a disperse condition.

In the case of the emulsified oils and greases, it has always been thought that a higher emulsifiability cleaner that can disperse more of this material would be an advantage. Present opinion has discarded this theory. It is now felt that a cleaner which will remove the oils and greases but not emulsify them gives better results. By skimming the accumulated oils from the surface of the solution with an overflow skimmer, the oil load in the solution is kept at a minimum value and there is less danger of oil drag-out into the subsequent pickle or plating solutions. As to the solid dirt the same reasoning does not apply since it cannot be skimmed off the surface. Some is removed by settling, but in general this dirt should be dispersed so that the metal surface rinses free of all foreign matter.

In summary, therefore, the cleaner must be kept within allowable limits as regards the dirt load for it to function properly. When this factor becomes so high that the drag-out contaminates subsequent solutions or the work cannot be rinsed dirt-free, no amount of additions to the cleaner bath will restore it to working efficiency. Here again, the limit is set by a slow build-up in the bath and not by any "break-down" of the cleaner. There is no way to determine this end point in any particular application except by experience. It is well to make up a new cleaner frequently according to the dictates of past experience since these materials are far cheaper than the labor lost due to rejects.

Drag-Out

This question has less to do with limiting the cleaner life than to wasteful extravagance. Of course, some work is of such nature that recesses and pockets carry out a large volume of cleaner solution, as it also does all along the plating line in the pickles, rinses, plating solutions, etc. Racking the work to the best advantage to give maximum drainage is the only means available to keep this loss at the lowest possible value. Periodic titration checks should be made on the solution so that fortifying additions can be made to overcome this waste. It should be mentioned here that heavy drag-out removes dirty cleaner solution and if compensated by regular additions, tends to oppose the deterioration resulting from soap, carbonate and dirt build-up. However, this compensation is obtained at the expense of increased cleaner consumption and a cost balance must be determined by the operator comparing the increased cleaner life against the amount of additions required.

Solution Volume

This factor pertains to the relationship between area of work cleaned and volume of cleaner solution. The larger the volume of solution for any given work load the longer it will require to overload it with dirt or grease. Conversely, a tank that is too small will very quickly reach its limit in dirt tolerance and too frequent dumping of the solution results. There is no fixed numerical value for this relationship. It might be argued that the cleaner solution cannot be too large, but in the interests of dimensional economy it would not be good engineering to have the cleaner tank too cumbersome in size. It also might be possible to have a volume so large in relation to the amount of work that conversion of the active alkali from saponification or carbonation would reduce the cleaning efficiency before it had a chance to give maximum returns on the investment. Generally, the cleaner tank is designed as is the plating tank, i.e., to accommodate the largest piece to be treated.

Adsorption

The wetting agents used in cleaners are surface active materials and, as such, distribute themselves at the surfaces of solid particles or at the interfacial surfaces of oils and greases. This means that they become depleted in the solution to the extent that the surface adsorption removes them. This action is inherent in all cleaners and is compensated for by the additions of new cleaner. Cleaner manufacturers should use sufficient surface active materials in their products to have a reserve so that the wetting out action will be effective throughout the life of the soluion.

In summary, it is necessary to balance the foregoing factors to get maximum results from the alkali cleaning bath. Keep the volume sufficiently large to tolerate the dirt load from one to four weeks. Longer periods of time may cause excessive carbonization and in some cases, excessive soap build-up. During these one to four week periods of time there must be sufficient active alkali maintained by regular additions of new material to support electrical conductivity and rapid emulsification or saponification of the oils and greases. Shorter periods of operation before dumping the solution may lead to higher cleaner consumption but this item is much cheaper than the labor cost invested in rejects or lost time due to shut-downs in the midst of a day's run.

This discussion is meant to show that the limits of cleaner life are caused by deterioration attributable to various chemical and physical changes and are not due to any sudden break-down of the cleaner chemicals.

EVAPORATION TECHNIQUES

(*Concluded from page* 64)

on the oxide-coated titanium. At the first evidence of titanium deposition the evaporation of copper is begun. At the first copper deposit the titanium source is turned off and the copper evaporation continued until no titanium shows through the surface. The resulting surface can be soldered to directly or can be built up by electroplating. This method can be adapted to coating rolls or flat plates in a continuous coater.

Responsible for the investigations on adhesion of evaporated coatings is Mr. Noel W. Scott, Physicist in the Engineer Research and Development Laboratories, Radiation Branch, Fort Belvoir, Virginia. Referring to this new process Mr. Scott said that outgrowths of the studies demonstrated that ". . . evaporated coatings can be used to advantage in processes for applying heat resistant coatings to metals, transparent conducting coatings to glass, and the manufacture of mirrors by a replica technique.

Acid Pickling Solutions

By E. E. Halls

IN the cleaning and metal finishing shops of engineering concerns, iron and steel components are pickled to remove rust and scale prior to subsequent operations. This operation may be necessitated because the material from which the parts are fabricated is "black," such as cold rolled close annealed mild steel which superficially may have a black scale varying from very thin to rather heavy, or "black iron" which is heavily scaled hot rolled steel bar, angle or section. Again pickling may be needed because cold rolled bright or semi-bright steel has become rusty in transit or storage, or at some stage in the component form. In any case, it is usually necessary to give a light acid treatment to all iron and steel components in order to remove oxide tarnish as one of a series of pretreatment operations prior to electro-plating.

Either hydrochloric or sulphuric acid is chosen for acid pickling processes of this nature. Hydrochloric acid as purchased contains about 30% of acid by weight and, in pickling solutions, it is used in concentrations from very weak to the undiluted acid itself; it may be employed hot or cold. A 50/50 mixture by volume of hydrochloric acid and water (*i.e.*, about 15% by weight of acid), operated at room temperature, is one of the most commonly employed pickles.

Sulphuric acid is approximately 98% acid strength, and it likewise is employed for pickling iron and steel at a range of concentrations, these chiefly being from 5 to 30% by weight of acid. It is used hot or cold, and one of the most widely employed sulphuric pickles comprises 7% by weight of sulphuric acid operated at 140 to 160°F. (60 to 70°C.).

Bright steel parts do not need a lengthy pickling time, a matter of seconds sufficing, but scaled and heavily scaled parts need appreciable immersion periods. Again, light superficial rusting may add only a few seconds to the immersion period, but heavy rust, particularly deep localized patches, needs a considerably longer period for treatment.

Choice of pickle is determined by a number of factors but, in factories handling a multiplicity of components, a compromise has to be effected and one pickle established to serve for all classes of work, or a small number to deal with several groups of similar parts, similar, that is to say, with respect to the contamination to be removed. Questions such as cost of acid, availability of heated tanks, rate of scale removal, and formation of carbon smut during pickling have to be considered. In general, the tendency is for the larger installations to use sulphuric acid hot and for the smaller shops to use hydrochloric acid cold.

A very important practical consideration is that no pickling process can be operated to the ideal of just removing the rust or scale; an excessive immersion time is unavoidable. Apart from any considerations of handling, this arises from the inevitable variation in depth of rust or thickness of scale from one component to another in the same batch and from one batch to another. Work may be grouped from experience into several grades for which different pickling times are allocated, but this time will be determined to satisfy the worst case in each grade.

For the above reasons it will be found in practice that clean bright steel work needing only a few seconds immersion in the acid may receive, say, a 15 minute soaking period, and work requiring 15 minutes may be given several hours, while some heavy scaled articles may be left in soak overnight for convenience. Generally speaking, this means a greater attack on the metal and a larger consumption of acid than is justified. C. H. Edwards [*Journal of Iron & Steel Institute*, 110, 9 (1924)] has described an instance in which pickling of 1,000 sq. ft. of steel sheet (both sides) for 15 minutes in a bath containing 35% of sulphuric acid at 200°F. without an inhibitor resulted in the removal of 6 lbs. of scale accompanied by a loss of 65 lbs. of metal. Thus, over 90% of the acid was wasted in dissolving iron over and above that required for the actual descaling. Moreover, the dissolution of metal is not evenly distributed over the whole surface of the component, so that unnecessary etching or pitting effects, or exaggerated patchiness of surface condition, are created and more grinding or polishing effort, more electroplate rejects for poor appearance, more time and labor on filling in enamelling processes, etc., result.

There are two ways in which these difficulties can be minimized. One is by studying the effects of the type of acid, its strength and temperature on pickling time for the range of materials used in component fabrication and, from the results, to select the most promising conditions for economic operation. In such a study, test specimens of standardized size, thoroughly degreased in trichlorethylene and by hot aqueous alkaline solution followed by thorough water rinsing, may be immersed in the pickle under controlled conditions of temperature. A large volume of the pickling solution should be employed so that the dissolution of scale, etc., does not materially effect the acid concentration of the bulk. Agitation of the specimen at a constant rate is useful to overcome local saturation of the solution; in commercial practice agitation should always be employed, either by movement of the work or solution. The latter is achieved by circulation or by air agitation in shop tanks.

Figures 1.-4. show graphically the results obtained

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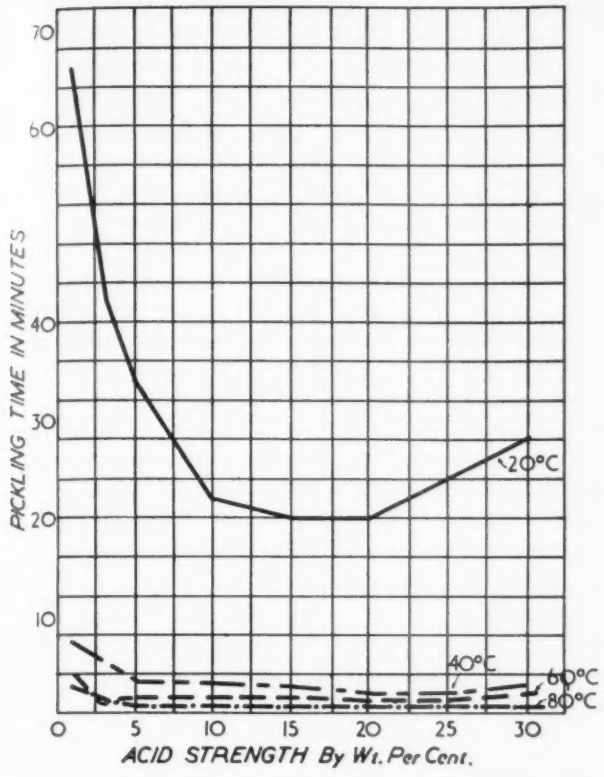


Figure 1. Pickling times for cold rolled, close annealed, mild steel in hydrochloric acid of different strengths.

by the author in a recent study of this nature covering the dependence of pickling time on temperature and acid concentration. Cold rolled close annealed mild steel was used to represent lightly scaled work and hot rolled black steel section or angle was employed to represent the extreme case. A large number of specimens was used to obtain average values for each test condition so as to level-out the variation of condition which is unavoidable from sample to sample. Each specimen was dealt with separately so as not to have several test pieces in a solution at the same time, with resultant possible interference with one another. Both hydrochloric and sulphuric acids were studied over a range of concentrations and temperatures, without inhibitor being present. Pickling time was assessed as the time taken for complete disappearance of the last trace of rust or scale from the work, the mechanical agitation referred to being the only aid provided *i.e.*, no brushing to remove loose scale being employed. With the very slow pickles, this added to the disparity of results.

It should be remembered that rust is removed in pickling by direct dissolution but scale is mainly cleaned away by acid attack on the lower layers of ferrous oxide adjacent to the steel, and the resultant mechanical lifting-off of the outer or upper layers of more tenaciously resistant material. Figure 1. illustrates the test results obtained for components from cold rolled close annealed steel when treated by immersion in hydrochloric acid solutions. The acid concentration covered ranges from exceptionally dilute (1% by weight) to concentrated (undiluted acid) and temperatures from room (20°C.) to hot (80°C.). At room temperature, the optimum concentration is 15-20% by weight of acid. At higher temperatures, pickling rates are very much faster, and they increase with increasing acid concentration to an intermediate value in the neighborhood of 20%, and then tend to remain constant or to decrease slightly. This explains the popular choice of 50/50 acid at room temperature but indicates that, as far as pickling time is concerned, weaker acid used warm has definite advantages. The use of warm acid, of course, introduces technical and economic problems of its own and time of pickling is not the only consideration by any means.

Similar material pickled in sulphuric acid solutions from 1 to 30% concentration by weight and over the same temperature range gave the results graphed in Figure 2. At the lower temperatures, the tendency for pickling rate to increase at higher concentrations is evident. Rates are generally lower than with hydrochloric acid, and a higher operating temperature is necessary to offset this shortcoming, *i.e.*, at least 40°C. This explains the general selection of an acid concentration in the region of 5 to 10% by weight, and an operating temperature from the range 60 to 80°C.; it is recommended that freshly prepared baths be operated at 40°C. with sufficient heat available in the steam line to permit of raising the temperature gradually to 80°C. over a period as the free acid content falls and the solution becomes saturated with iron salts.

Figure 3. deals with black steel specimens in the hydrochloric acid pickles, with a range of conditions similar to those in Figure 1. The pattern of the figures is similar although the pickling times themselves are much longer. The 15-20% concentration by weight is again an optimum range throughout.

Figure 4. gives similar pickling time values for black mild steel specimens in the sulphuric acid solutions, which should be compared with the results pre-

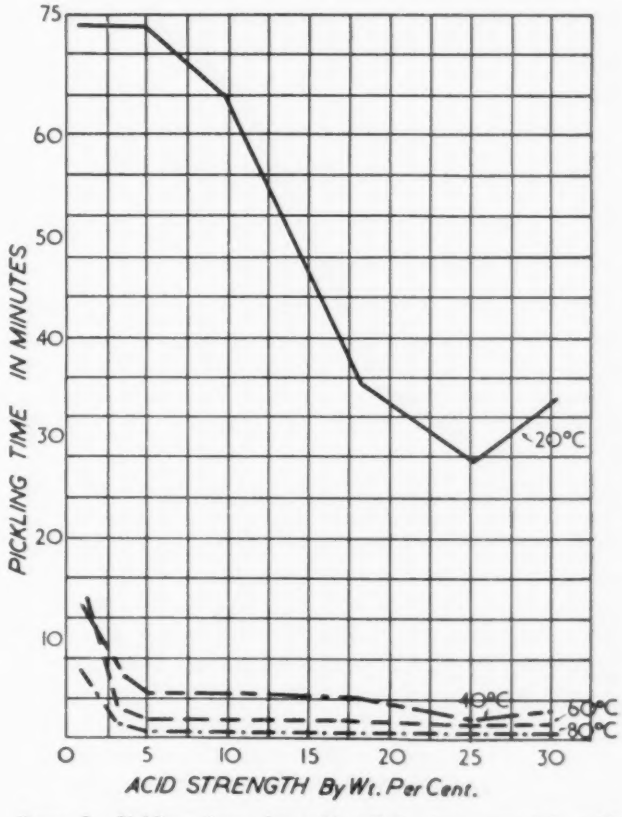


Figure 2. Pickling times for cold rolled, close annealed, mild steel in sulphuric acid of different strengths.

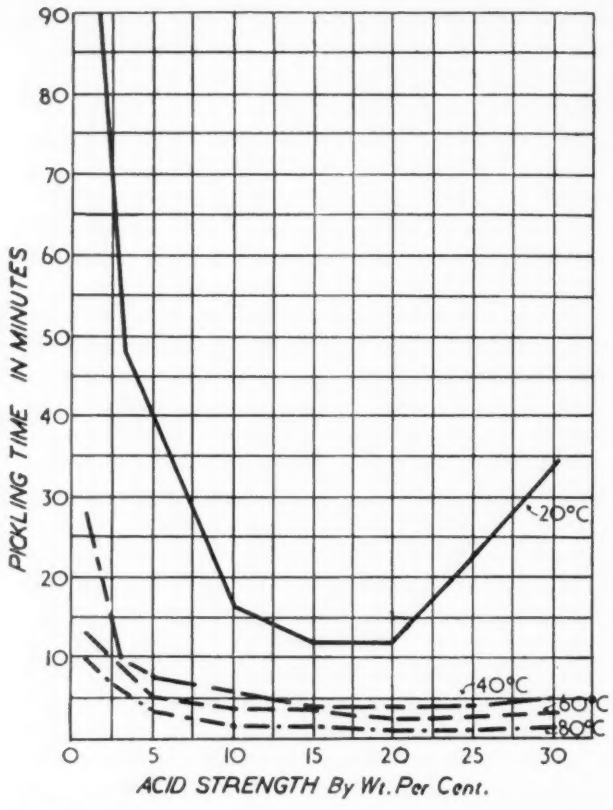


Figure 3. Pickling times for black mild steel in hydrochloric acid of different strengths.

sented in Figure 2. (It would be noted that in order to obtain proper representation of each curve, the scales used in the above figures are different in each case). They show the same trend and indicate the need for sulphuric pickles to be operated hot and at the higher concentrations for maximum speed of operation. It should be mentioned that, in the sulphuric solutions, with further increase in concentration above 30%, pickling rate decreases, *i.e.*, pickling times increase.

With increasing pickling times, the amount of base steel (as distinct from oxide in the form of rust or scale) that dissolves increases. A rise in temperature also produces an accelerated attack on the iron itself.

Effect of Pickling Inhibitors

The second and equally important way of reducing acid consumption and avoiding undue solution and roughening of the metal surface is by the use of inhibitors. These materials accelerate the solution of the oxides but retard that of any exposed steel. In addition, in many cases, they form a scum or foam on the liquid surface which cuts down the loss of acid by spray. Thus, they reduce acid consumption in two ways and minimize that uneven dissolution of bare metal which results in roughness and pitting. Pickling inhibitors are usually organic compounds. Many of them are colloidal in nature; glue, gelatin and concentrated glue size are examples, but these haven't usually the same inhibitive action as certain organic bases containing nitrogen, such as organic amines of aromatic and aliphatic types, quinoline and iso-quinoline, and pyridine. The crude nitrogenous bases in coal tar and petroleum residues have proved to be satisfactory as pickling inhibitors; they are extracted with acids and referred to as "'acid extract" of coal tar or petroleum respectively. The benefit to be derived from the use of inhibitors, even when dealing with mild, bright steel components, is quite surprising.

The way in which these inhibitors function has not been satisfactorily elucidated, but it no doubt comprises several effects. There is probably a preferential deposition of a film of inhibitor of a colloidal nature on the bar iron or steel, and not on the rust or scale. This may retard liberation of hydrogen from the iron surfaces (which are anodic to the oxide) and thereby suppress attack on the iron. The film also adds to the electrical resistance, which again tends to lower the rate of attack on the iron. It may also involve migration of strongly polar groups to the bare steel surface and an increase in the hydrogen overvoltage at that surface, which amounts to much the same thing.

The reduction of hydrogen evolution is also valuable inasmuch as it reduces the likelihood of hydrogen embrittlement and the formation of pickling blisters on sheet metal.

In addition to their ability to effect film formation or increase of hydrogen overvoltage, successful inhibitors must be easily and completely soluble in acid, completely stable and able to retain their beneficial effect on prolonged storage. If the inhibitor is of the foaming type, it should not be unduly so as there is an undesirable tendency for the inhibitor to concentrate in such surface foams. After pickling, a very thin film of inhibitor, or its decomposition products, is left on the metal surface, and this should be of such a nature that it can be easily removed, for example, by anodic alkaline cleaning, to prevent interference with electroplating and other subsequent surface treatments.

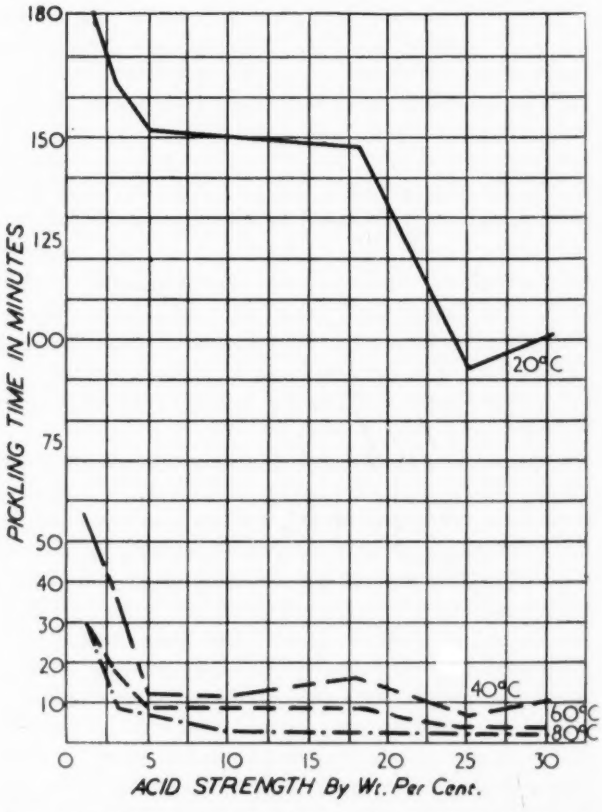


Figure 4. Pickling times for black mild steel in sulphuric acid of different strengths.

5—Loss in Weight in Milligrams/Sq. In. of Bright Mild Steel Specimens Pickled in Inhibited 50/50 V./V. Hydrochloric Acid Solution at Room Temperature

Inhibitor No.	Pickling Time—(Hours)	Per Cent Concentration of Inhibitor 0.00	0.05	0.10	0.50	1.00
1	¼	1.1	0.50	0.50	0.33	0.37
	1	2.5	1.0	1.0	0.75	0.70
	24	36.7	3.6	2.7	1.7	1.3
2	¼		0.50	0.50	0.50	0.42
	1		0.83	1.0	1.0	0.83
	24		2.0	2.5	1.5	1.5
3	¼		0.50	0.42	0.43	0.50
	1		1.0	0.83	1.1	1.3
	24		2.1	1.8	1.8	1.8
4	¼		0.30	0.10	0.20	0.17
	1		0.58	1.0	0.75	0.32
	24		2.7	2.1	1.5	0.91

Inhibitors are sometimes mixed with diluents to assist stability or solubility and there is generally an optimum concentration in the region of 0.05—0.10% by weight of the pickling acid.

Many substances have been suggested as inhibitors and their suitability examined, including glue, gelatin and casein, nicotine, aniline, pyridine, quinoline, substituted ureas and thioureas, thioformaldehyde, and many others, together with the crude coal tar and petroleum bases already mentioned. Of these, very broadly speaking, the crude coal tar bases have proved to be the most effective materials for the purpose, and the petroleum bases good but not quite so beneficial. Gelatin occupies an intermediate position. Pure materials, such as pure aniline and pure quinoline, are not so effective as the acid extracts from tar.

The experiments carried out by the author, the results of which are described below, were performed using four different inhibitors—quinoline and three proprietary inhibitors. Quinoline is referred to as No. 1. Inhibitor No. 2 was a mixture of crushed glue size mixed with an aromatic amino derivative, estimated to be a 50/50 composition. Inhibitor No. 3 was a somewhat similar type of formulation. Inhibitor No. 4 was a liquid of specific gravity 1.51, comprising a mixture of sulphuric acid, hydrochloric acid, water and an aromatic nitrogenous substance. It was believed to be an acid extract of coal tar. A fifth inhibitor, results for which are not given here as it behaved very similarly to No. 4, was a liquid very like No. 4 but containing no hydrochloric acid. Specific gravity was 1.56. The experiments cover a selected pickling condition from each group, *i.e.*, cold 50/50 V./V. Hydrochloric acid at room temperature and 7% W./V. Sulphuric acid at 70°C. The raw material tested covered bright and black lightly scaled forms. The loss in weight of the specimens was recorded at various intervals of immersion time and computed to milligrams loss per sq. in. of area. This loss in weight is shown for specimens pickled in the absence of inhibitor as well as in the presence of inhibitor in concentrations of 0.05%, 0.10%, 0.50% and 1.0%.

With the bright steel test pieces, weight losses comprise a little oxide film plus metal; in the case of the black C.R.C.A. specimens, it is made up of much scale plus some metal. The figures recorded are each averages for several tests, because obviously such measurements are rather erratic, varying considerably not only with the amount of scale present but also with its composition, physical condition and distribution. Again, the performance of a single inhibitor is liable to vary with the nature of the work and its surface condition, as well as with operating variables of time, temperature, acid nature and concentration.

Throughout the tables, lesser attack on the specimen, *i.e.*, smaller weight loss, occurs when inhibitor is present, independent of its concentration. Generally speaking, the higher the inhibitor concentration, the more effective is the restraining action, although this is not marked in all cases. Also, the longer the immersion time, the more effective it becomes *i.e.*, the rate of dissolution of metal rapidly reduces. Detailed comments on the results are briefly noted below:

Table 5—Bright Steel in Hydrochloric Acid Pickle

(a) At low inhibitor concentration, the weight loss is reduced to less than half in the 15 minute period, and less than one tenth in the 24 hour immersion time.

(b) At high inhibitor concentration, the weight loss is reduced to less than one twentieth of that with no inhibitor.

Table 6—Bright Steel in Sulphuric Acid Pickle

(a) At low inhibitor concentration, weight loss is reduced to less than one quarter in the 15 minute period, and less than one twelfth at high concentration.

(b) Rather more difference is recorded between the inhibitors, with No. 1 the least effective, but all of them very good.

(c) Some difference of inhibitor action is observable between the different inhibitors: this is not generally large, but is a question of evaluating in conjunction with price per pound because concentration as supplied by the supplier may vary, apart from actual nature.

6—Loss in Weight in Milligrams/Sq. In. of Bright Mild Steel Specimens Pickled in Inhibited 7% W./V. Sulphuric Acid Solution at 70°C.

Inhibitor No.	Pickling Time—(Hours)	Per Cent Concentration of Inhibitor 0.00	0.05	0.10	0.50	1.00
1	¼	30.0	7.0	4.3	2.7	2.5
	1	123.0	33.2	17.0	5.1	3.7
	24		-	-	5.5	4.0
2	¼		1.5	0.42	0.50	0.42
	1		3.1	1.5	1.1	1.0
	24		3.7	1.8	1.6	1.4
3	¼		1.7	1.3	0.6	0.51
	1		4.5	3.3	1.7	1.5
	24		5.2	4.2	2.3	2.1
4	¼		3.0	1.7	0.87	1.0
	1		4.0	2.4	1.6	1.6
	24		8.0	6.5	3.8	2.7

Table 7—Black C.R.C.A. Steel in Hydrochloric Acid Pickle

(a) Remembering scale loss must be experienced, about one third saving in weight loss in the 15 minute period, and 75% saving in the 24 hour period is achieved. An exception to this is inhibitor No. 4 in the 15 minute immersion time for 0.05% concentration.

(b) Performance of the four inhibitors is very uniform.

(c) Weight losses are very small after the first 15 minutes, *i.e.*, inhibitor action over extended time is exceptionally good.

Table 8—Black C.R.C.A. Steel in Sulphuric Acid Pickle

(a) The losses in uninhibited sulphuric acid are much greater than in hydrochloric acid (see Table 7).

(b) The losses in inhibited acid are rather greater in sulphuric than in hydrochloric acid, but then amount of loss prevented by the inhibitor is much greater.

(c) The use of inhibitors in the sulphuric pickle becomes imperative on account of the greater attack of this acid on iron.

The time required for pickling in the various acid solutions is virtually unaffected by the inclusion of an inhibitor. This has been shown for the range of inhibitors dealt with, and over the limits of concentration used above. There is thus no practical objection to the use of inhibitors, and their cost is very much more than offset by the saving in acid consumption. Added to this benefit, there is less attack on, and damage to, the metal, and a reduced quantity of spent acid to be dealt with, a by no means negligible item.

Again, if the metal components involve bimetallic junctions, serious attack at the latter may be eliminated entirely. Black structural work having zinc coated medium carbon steel pins riveted in position, has been known to have the pins completely destroyed by long pickling in cold 50/50 V./V. hydrochloric acid. With inhibitor present, this damage is entirely

7—Loss in Weight in Milligrams/Sq. In. of Cold Rolled Annealed Mild Steel Specimens Pickled in Inhibited 50/50 V./V. Hydrochloric Acid Solution at Room Temperature

Inhibitor No.	*Pickling Time—(Hours)*	*Per Cent Concentration of Inhibitor* 0.00	0.05	0.10	0.50	1.00
1	¼	20.0	13.3	12.8	12.7	12.3
	1	30.0	14.5	13.0	12.9	12.5
	24	80.0	19.2	14.7	13.6	12.6
2	¼		13.3	14.1	14.3	13.3
	1		14.0	15.0	15.2	13.9
	24		16.7	16.0	16.7	15.7
3	¼		11.8	12.0	13.7	12.7
	1		12.2	12.5	14.3	13.2
	24		14.0	14.2	17.2	16.0
4	¼		19.2	13.0	13.7	12.5
	1		19.4	13.1	14.1	12.7
	24		20.8	15.0	15.2	14.0

8—Loss in Weight in Milligrams/Sq. In. of Cold Rolled Close Annealed Mild Steel Specimens Pickled in Inhibited 7% W./V. Sulphuric Acid Solution at 70°C.

Inhibitor No.	*Pickling Time—(Hours)*	*Per Cent Concentration of Inhibitor* 0.00	0.05	0.10	0.50	1.00
1	¼	53.0	17.7	20.0	15.0	15.0
	1	208.5	30.0	28.3	16.7	16.5
	24	-	34.9	33.5	18.3	18.0
2	¼		17.5	15.0	23.5	17.8
	1		19.2	16.9	24.7	20.0
	24		23.5	18.0	26.0	21.0
3	¼		13.4	17.2	12.5	13.5
	1		17.0	28.6	15.0	14.4
	24		20.0	30.6	16.7	16.2
4	¼		15.8	15.6	13.0	14.6
	1		17.6	17.0	13.8	15.6
	24		28.2	25.3	18.0	17.0

avoided. The same protection is provided for brass/steel junctions, or even for combinations of mild steel and high carbon steel. Further, the degree of hydrogen embrittlement can be expected to be appreciably lower in inhibited pickles, and the possible deterioration at autogenous and resistance welds may reasonably be anticipated to be much reduced.

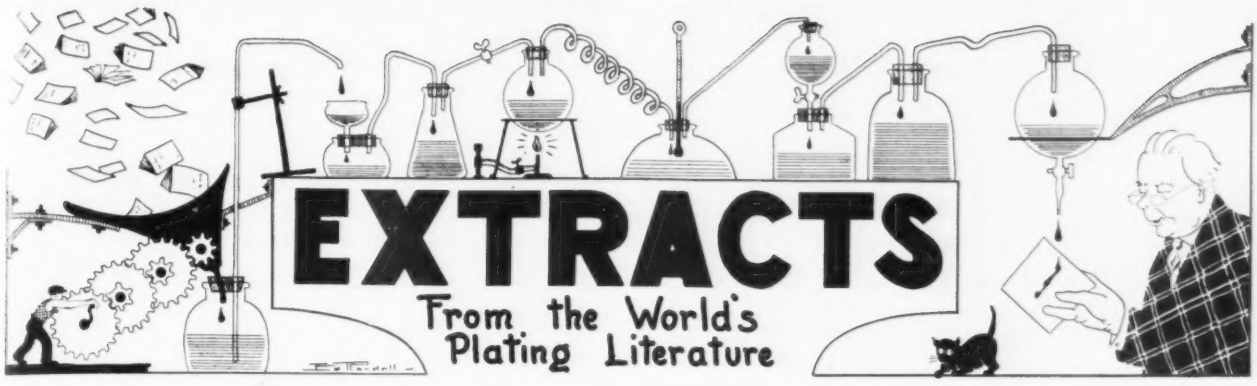
The actual choice of pickle is determined by a number of factors, some of which have been touched upon earlier. Bearing in mind that commercial hydrochloric acid contains only 30% of acid against 95% min. for sulphuric acid, and allowing for the relative chemical equivalents (which determine the combining power of the acids with rust, etc.) of the two materials, *i.e.*, 36.5 and 49 respectively, the raw material cost of hydrochloric acid is appreciably greater than that for sulphuric—at least 3 to 1.

Heat is also an aid to economy, at least from the conservation of acid point of view. The cost of steam of course, can by no means be neglected, but it is less costly than acid and labor. Dragout waste for any particular type of work is fairly constant in volume for a given technique of operation, and it may be quite high. The wastage will naturally be greater the stronger the acid solution used, so that an elevated temperature assists in this direction.

A good practice is to operate at a suitable low acid concentration and optimum temperature, and to make acid additions as the acid becomes spent to keep a reasonably constant free acid value. When the iron value of the solution rises to a certain level, no further acid should be added, but the temperature raised somewhat to expend most of the residual acid before scrapping the solution.

Some laboratory work is necessary alongside the operation of the pickle in the shop tank in order to determine the best and most economic conditions for the class of work and the purpose for which the acid is used. For example, a 5% sulphuric acid pickle operated at 60 to 80°C., may show a rise in specific gravity from 1.05 (at room temperature) to about 1.18 when the iron content is of the order of 8%, and this can be used to a free acid content of about

(*Concluded on page* 81)



Pickling of Stainless Steels

J. Bary; *La Metallurgie*, vol. 84, No. 4, pp. 259-261.

The nitric-hydrofluoric acid pickling bath for stainless steel has serious disadvantages. It can be used only at normal temperature because, even at this low temperature, the atmosphere surrounding the pickling bath becomes noxious on account of the evolution of HF and NO_2. The hydrofluoric-ferric sulfate bath is accordingly assuming more and more importance for the pickling of stainless steel. The solutions of ferric sulfate have two interesting properties from the pickling aspect; while the solutions are slightly acid by hydrolysis, they are oxidizing by virtue of the ferric ions which they contain and which are located between hydrogen and nitrate ions in oxidation potential. The oxidizing ions, considered from the pickling aspect, and the metals frequently encountered are located in the electrochemical series in the following order:

$$Zn - Cr - Fe - Ni - H_2 - H^+ - Cu - Fe^{+3} - NO_3 - Cr_2O_7$$

According to this series, the ferric salts in solution are pickling agents for the metals which precede Fe^{+3}, i.e. zinc, chromium, iron, nickel and copper. Under laboratory conditions the best pickling results with hydrofluoric-ferric sulfate solutions for stainless steels are obtained with proportions such that a ferric fluoride is formed according to the equation:

$$Fe_2(SO_4)_3 + 6\,HF = 2\,FeF_3 + 3\,H_2SO_4$$

which is 4 per cent of ferric sulfate for 1.2 per cent of hydrofluoric acid.

If a comparative pickling test is made between such a solution and a pickling bath containing 25 per cent nitric acid and 2 per cent of sodium fluoride, the loss in weight of stainless steel samples covered with heat scale formed at 1000°C. and of stainless composition 18-8 with 2 per cent molybdenum are respectively 30 g./sq. m./hour with the ferric sulfate solution and 16 g./sq. m./hour with the nitric bath. Once the scale coating has been removed the rate of attack changes; it is then the nitric acid bath which retains a solution rate of the metal of 5 g./sq. m./hour while the loss in weight in the ferric sulfate bath falls to 0.09 g./sq. m./hour.

Pickling under industrial conditions, with welded seam joints, it is necessary to modify the above proportions. A good practical working bath is composed of about 6-8 per cent ferric sulfate and 2 per cent hydrofluoric acid. In place of hydrofluoric acid, fluorides in the presence of sulfuric acid can be used in the bath. Thus, an appropriate bath composition would be: calcium fluoride 50 g.; 66° sulfuric acid 130 g.; ferric sulfate 80 g.; water 1,000 cc.

This bath composition works well with an 18-8 stainless steel with 2 per cent molybdenum and the solution of the oxides present along the weld seams is rapid; on the contrary, the metal attack is slow. Pickling is finished in 10 to 30 minutes at normal temperature in baths containing less than 5 per cent ferrous sulfate. There is an upper limit for the content of ferrous sulfate, and above this limit the baths pickle poorly. In baths working at 60°C. this content can attain 20 per cent. The consumption of ferric sulfate, resulting in its transformation to the ferrous salt during the pickling, is higher than that of the hydrofluoric acid. On the average the bath must be replenished twice with ferric sulfate before more hydrofluoric acid is needed. With a low ferric sulfate content, the pickling is accompanied by a slight gaseous discharge and the parts are covered with a slight coat of red iron oxide. With a low HF content (less than 1.2 HF for 4 $Fe_2(SO_4)_3$) the pickling time lengthens and the results obtained are not as good.

Rinsing Techniques

J. Liger; *La Metallurgie*, vol. 84, No. 4, pp. 261-263.

There are several factors conducive to good rinsing conditions and which must be strictly observed and controlled to obtain satisfactory results; it is not always realized that a perfect plate can be impaired during rinsing operations conducted under bad conditions. The first and most obvious requirement is to utilize a suitable water for the rinse. When this water has served for three or four series of parts it has become impure and should be discarded. Filling and emptying of rinse tanks is a tedious and time wasting operation and the best solution is to adopt continuous circulation. It is preferable to employ tanks of relatively small volume and the water supply being arranged to arrive at the lower part and to leave at the upper part. The parts immersed in the rinsing water should be agitated; in the case of recessed parts a single immersion is not sufficient to remove solution entrained in the recesses and several successive immersions are necessary to ensure this. Compressed air agitation of the rinsing bath is very satisfactory. For parts of large or medium surface area, subsequent rinsing by a jet of water is a

satisfactory complement to normal tank rinsing. In the case of recessed parts again, air trapping in the hollow portions should be guarded against; the parts should be placed so that the rinsing water circulated freely into all the recesses of the piece.

Special care is necessary in the case of rinsing before and after barrel plating. Here large numbers of fairly small parts are normally handled and considerable amounts of entrained solution are carried into the rinsing tanks. Before plating, all cleaning solutions must be carefully eliminated and, after plating, particularly with bright plating, the plating solutions carried over to the rinsing stage must equally be scrupulously removed, to avoid tarnishing of the deposits. Barrel rinsing is usually the most suitable equipment to adopt here.

The rinsing operations should be conducted with the greatest possible speed and the parts passed without delay from one bath to another. The parts must be progressed quickly from the plating through the rinsing and drying stages and not allowed to remain in the air between any of these operations, to avoid oxidation and undesirable chemical reactions on the plated surface. This is particularly the case at the final rinse and drying stages and also especially with barrel and bright plating. It is also good practice to specialize the rinsing tanks and not to treat in the same rinsing water parts proceeding from plating baths of a different nature even with circulating rinse water. The mating of different entrained plating bath liquors in the rinsing tank is liable to lead to precipitates and staining on the plated ware. Warm water is best, at least for the first rinse.

Degreased parts sometimes have to be stocked before passing to the plating bath. This should never be done in air but under a solution rendered slightly alkaline by the addition of sodium carbonate. When required, the parts are taken from the storage vat, rinsed again, followed by an acid rinse; in any case such storage should not be more than several hours.

Protective Plating for Light Constructional Steelwork Units

W. Wiederholt: *Werkstoffe und Korrosion*, vol. 2, No. 10, pp. 372-377.

The modern tendency in building construction is for the use of lightweight steel constructional elements of either tubular or shaped sheet metal construction. These are taking the place of the massive rolled steel sections formerly employed. By suitable design measures it is now possible to reduce the thickness of the steel load bearing members to less than 4 mm.; for safety reasons, a thickness of 1.5 mm. should be regarded as the absolute minimum. Suitable design, special profiling, standardization of the individual parts and combination with new modern building materials, has resulted in the flow production manufacture of these metal building units on a large scale, characterized by low weight, statically favorable sectional shapes, and easy building assembly. Floor and roof constructions are among the most important applications of these units.

Because of the comparatively light sectional thicknesses of metal used, corrosion protection is of profound and fundamental practical significance. Considerable attention has been given in Germany to this question, and standards of practice have been outlined. This is necessary as the load bearing elements have only a small relative thickness and the permissible stresses are used as fully as possible. Every fall-off in the strength value by reduction in the cross-section, as would be caused by corrosion of the steel when in use, must be prevented with these light building elements. A test was made with a copper-bearing constructional steel with no corrosion protection, of a test thickness of 0.5 mm. After two years test exposure, this steel had no load bearing capacity at all. In the case of a 10 mm. thickness of steel, with no corrosion protection, after three years the load bearing capacity had been reduced by 10 per cent. With a 1 mm. thick test piece, the reduction in strength value was 50 per cent for the same test period.

German Standard DIN 4115 covers protective coating for parts exposed in the open and in non-enclosed buildings, for the first schedule. The second schedule covers protective coating in the interior of enclosed buildings with normal corrosion conditions. The steel thickness should be at least 3 mm. in the first case and at 1.5 mm. for the second schedule.

Regarding the practical protective metal coatings, only zinc and lead are of importance here. Zinc is stable against normal atmospheric influences and is capable of standing up to chemically aggressive atmospheres, such as combustion gases. Plating of zinc and lead on the steel units requires particularly careful pretreatment in order to obtain adherent and thick coatings. The plating is conducted so as to give a thick, finely crystalline coating. Careful control of the plating conditions allow of coating to thickness specification. Careful rinsing is necessary after plating to eliminate bath liquor, followed by rapid drying.

The pores in the zinc coating need not be regarded as particularly dangerous because, under normal conditions, zinc is anodic to steel. On the other hand, lead coatings must be dense and free from pores as iron is less noble than lead. At unsound parts of the lead coating, as for example where pores or pits are present, pitting corrosion of the steel surface commences, which in a relatively short time can lead to serious reduction in the steel section thickness.

The specifications requirements for the metal coatings for this application are comparatively for different processes:

First Grade: Minimum coating thicknesses:

Hot dip galvanizing	300 g./sq. m.
Plated lead coating	500 g./sq. m.

Second Grade:

Metal sprayed zinc coating	1,000 g./sq. m.
Plated zinc coating	150 g./sq. m.

Disposal of Pickling Waste Liquors by Neutralization

G. Rossi-Landi; *La Metallurgie*, vol. 84, No. 3, pp. 183-185.

Disposal techniques for handling pickling and rinsing waste liquors have still remained largely as somewhat haphazard procedures and the same amount of thought has not been given to this question as has been devoted to the actual processing stages of the

pickling and rinsing operations. Account is not taken of concentration differences in the residual pickling and rinsing liquors as they arrive at the disposal station and, accordingly, a uniform and regular neutralization mixing is not obtained. The neutralization is accordingly ineffective. To ensure a good mixing of the exhausted liquor with the rinsing water, employ either agitating equipment or suitable mixing channels.

If the pickling layout allows of this, a perfect neutralization without residues can be obtained by using large neutralization vats with steam coils, the elevated temperature allowing of a facilitated reaction. Residual alkaline cleaning liquors can also be usefully employed for the neutralization. With lime neutralization, the atmospheric air plays an important role in the intimate mixture between the lime and the waste liquor and care should be taken that a crust does not form on the surface of the vat, or to break it up if one has formed. Chalk, marble powder or limestone can also be used for the neutralization but this must be kept in suspension to be effective.

A complementary method which is largely adopted in practice consists in constructing a filtration treatment basin in limestone, the unit being aerated and ventilated. In this way, the transformation into iron hydroxide is facilitated and a flocculent precipitate, which can be easily handled, is more readily obtained. The neutralization is facilitated by the ventilation. Decantation basins for neutralization treatment of waste pickle liquors require detailed supervision. When the lime is added, care must be taken that too much is not added so that the water does not become too alkaline. The aim in the treatment should be to produce a ferric hydroxide precipitate which is as flocculent as possible; a precipitate of a slimy, finely dispersed nature is difficult to filter and handle and a flocculent precipitate will filter much more easily and quickly and so allow of a reasonable sized treatment plant unit.

Hard Chrome Plating in Engineering Techniques

Galvano (Paris) vol. 21, No. 184, pp. 26-28.

To obtain a thick coating of hard chromium within a commercially reasonable time and of satisfactory quality it is obviously necessary to employ higher current densities than are normally used in chromium plating techniques. This is possible and burnt deposits are avoided even with very high current densities if a bath is used which contains a high content of sulfate ions and the bath is worked at a high temperature. Apart from the fact that such a procedure of operation is characterized by very rapid plating, in addition the quality of the chromium deposit is definitely improved. This is particularly the case as regards the mechanical properties of the deposit and the covering power is increased. With a bath composed of 275 g./L. chromic acid and 5 g./L. surfuric acid, at 70°C. compared with the normal chromium plating bath, the chromic acid content is increased slightly, the sulfuric acid content is doubled and the operating temperature raised from the former 55°C. The efficiency of the bath is approximately doubled and very much higher current densities than usual can be employed. The baths are also characterized by stable working conditions and several years of continuous operation have been recorded from one bath. Working with such high current densities with these rapid chromium plating baths, of the order of 300 amp./dm.^{2}., several technical factors must be observed. Sufficiently heavy busbar sections must be employed for the high current concentrations used and a reduction is made in the distance between the insoluble anode and the piece being treated.

Although the equipment layout is more costly, this is compensated by the fact that each production unit is capable of turning out several times the amount of work of a normal hard chrome plating unit. Because of favorable polarization conditions both on the anode as well as the cathode, normal plating voltages are used. The rapid bath is characterized by considerable operational elasticity and, while normal operating densities are from 100 to 300 amp./dm.^{2}, it is possible, if required, to operate the bath up to 1,000 amp./dm.^{2}. The speed of the deposition varies between 0.003 and 0.008" per hour. This compares with 0.001" for a normal hard chrome bath.

It has been found that the chromium deposit obtained from these rapid baths working at a higher temperature than normal are better suited to engineering applications, where wear resistance and hardness are required, than the deposit from the normal chromium bath. Deposits of a hardness of about 825 Vickers can be obtained from the rapid bath, working at a high current density and high temperature and this corresponds to about the hardness of sapphire.

ACID PICKLING SOLUTION

(*Concluded from page 78*)

1%. Similarly at 10% hydrochloric acid pickle operated at 30 to 40°C., will rise from 1.04 to about 1.20 with an iron content of about 12%, and again it may be used down to an acid value of about 1%. Generally, it is desirable not to employ the pickle to exhaustion on the actual plating line but to replace it at frequent periods, *e.g.*, daily, and to transfer it to the main cleaning section for heavier pickling.

For some purposes, a pickling mixture of both sulphuric and hydrochloric acids is useful for rapid attack on scale or rust. Again, another laboratory job is to ensure that the pickle selected for the particular work does not produce an objectionable black sooty smut, which cannot be removed from the work except by hand scouring.

Attention to these various details will aid productivity, reduce costs and help materially in conserving acids which are in short supply.

CORRECTION

In the article by Louis Serota, appearing in the August issue, two typographical errors on page 75 have been brought to our attention by the author. The figure 20.9 in the left column should have been 20.8 and the first equation in the right column should have had the fraction $\frac{NiCl_2 \cdot 6H_2O}{Ni}$ instead of $\frac{Ni}{NiCl_2 \cdot 6H_2O}$

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Brown on Nickel Anodes

Question: The anodes in my nickel solution get a brown and muddy deposit on them. Please tell me how to correct this condition.

Answer: You are evidently using anodes of the cast type and known as 95-97 anodes which means that the anodes are 95 to 97% nickel and the remainder of the material (3 to 5%) is iron and carbon. The iron and carbon are added to facilitate casting of the nickel and to improve its corrosion in the nickel bath.

The deposit you have on your anodes is composed of iron and carbon and may be readily removed by scrubbing. This sludge, if allowed to remain on the anodes, may fall off into the bath and contaminate the solution causing rough deposits or pitting.

The best type of anode to use is the 99% plus nickel anode. In order to obtain active corrosion of this anode, the chloride content of the solution must be maintained at 3.0 oz./gallon or higher. While this type of anode will give no trouble from mud formation, for best results it should be bagged.

Chromated Zinc Deposits

Question: We are zinc plating small parts, rinsing in warm water to remove cyanide, and immersing in a chromate bath from 10 to 14 seconds. The Chromate bath is made up of 26.6 oz. dichromate and 1.2 oz. sulfuric acid to each gallon water.

Lately, we get batches of work on which the chromate finish rubs off after the work lays finished for some time.

Answer: We suggest that you try a cold water rinse followed by the chromate dip and followed again by a cold water rinse. The hot rinse should be eliminated as the chromate finish is sensitive to heat and will not be adherent if a rinse is used above about 160°F. Blow the water off with compressed air. Reduction of the acid content to 0.8 fluid ounce may also be of help.

Nickel Plating on Rubber Lining

Question: We have experienced a puzzling phenomenon, namely, the nickel plating on the rubber lining of our plating tank. Can you explain this?

Answer: It has been found that the anti-oxidants used in rubber compounding will affect some types of nickel solutions and will also cause deposition of metals on the surface of the rubber. Sometimes the sulfur content in rubber is blamed for this type of plating.

Because some types of rubber are poor insulators, it would be wise to check your tank for possible current leaks at these points: steam coil and anode and cathode bars, water lines and floor or bases. These points should be insulated perfectly to insure against leakage.

As a general rule, it is best to test any rubber lining for its compatability with nickel solutions before using. A simple test is to soak the lining in a nickel solution for 72 hours at a temperature of 140-150°F. Then using a Hull cell, plate a panel and note the effect of the rubber, if any, throughcut a specified current density range.

24 Hour Salt Spray Cadmium Plating

Question: Will you please let us know what thickness of cadmium should be plated on steel to withstand a 24-hour salt spray test?

Answer: For most cases, a cadmium deposit of 0.0002″ over steel is considered sufficient to stand up in a 24-hour salt spray test.

Thinner deposits will stand up if the base metal is of good finish and free from imperfections and the plating bath is free from suspended matter. Generally one or more of these conditions are not satisfied in commercial practice.

Conversely, if very poor base metal is being plated, or if the plating is of poor quality because of incorrect bath conditions, a deposit heavier than 0.0002″ will be required.

Removing Fire Scale From Silver

Question: Please let us know the best way of removing fire oxide from silver?

Answer: Pickling in a solution of 75% Nitric acid and 25% water is the best and easiest method of removing fire scale from silver.

Clean work before going into the solution, then immerse in the acid or pour the acid over the work until scale is removed. Save the acid and rinse waters to recover the silver as a chloride precipitate.

Recovering Rhodium

Question: How can rhodium metal be reclaimed from wires or plating hooks?

Answer: The only way of reclaim-rhodium from wires or plating hooks is to cut up the wires or hooks into small pieces and then dissolve the base metal with nitric acid. The rhodium will remain as shell fragments or chips after all the base metal has been dissolved.

Dull Spots on Chromium

Question: In the February number of METAL FINISHING we read a report of British Metal Finishing Productivity Team on British versus American Practices. In this report is mentioned that in the U.S.A. almost universal use is made of cleaning and activating cycles interposed between nickel and chromium plating. We have recently had some trouble with dull spots and

sometimes peeling off of chromium deposits on bright nickel (organic type) on steel. When we cleaned the bright nickel plated parts no dull spots were formed and the chromium plate was adherent. The bright nickel was all the time of very good quality. There seemed to be some invisible (organic?) coating upon the bright nickel which had to be removed before chromium plating and we use the same rack for both bright nickel and chromium plating. We should be very grateful if you would tell us what kind of cleaning and activating cycles we should use after the bright nickel plating. Is there really any invisible organic coating on the bright nickel plated parts?

P. O. B.

Answer: Most plants prepare nickel plated articles by first cleaning cathodically in hot alkaline cleaner, rinsing, acid dipping, rinsing and then chromium plating. We know of no definite identification of the film on bright nickel, but the above treatment gives good results.

For acid dipping, hydrochloric acid (10% by vol.), sulfuric acid (2-20% by vol.) and hydrofluoric acid (2-10 by vol.) have been reported. We do not recommend hydrochloric acid if there is any possibility of entrapping the acid and carrying it into the chromium solution since it will cause corrosion of lead linings, coils and anodes.

Impurities in Chromium Baths

Question: What are the permissible iron, copper and trivalent chromium concentrations in a chromium plating bath for optimum conditions for plating of chromium (0.00025 in.) over bright nickel? We use a bath containing 400 g./l CrO_3 and 4 g./l. SO_4 at 43° C. (109°F.).

P. B. D.

Answer: We can offer no authoritative figures on maximum concentrations of iron, copper and trivalent chromium in chromium plating solutions. A search of the literature will probably give you sufficient data to confuse you completely. Of course, since these metals will combine with the hexavalent chromium to form dichromates which are complex and nonionized, the theoretical limits will be those where all the hexavalent chromium is tied up and the conductivity is zero.

Aluminum Treatments

Question: In our plant we have just started doing colored anodizing, using the sulphuric acid process. I would appreciate it very much if you would send me whatever information on this you have. Also, I'm interested in bright dips for aluminum.

G. L. L.

Answer: The 1951 edition of the GUIDEBOOK-DIRECTORY has an extensive section on the subject (pages 428-36), including sulfuric acid solution operation and dyes.

Bright dips for aluminum are either patented or are in the stage of being patented. Prepared solutions may be available from your supply house. Processes are available from Aluminum Co. of American and from Kaiser Aluminum & Chemical Sales, Inc.

Precipitating Heavy Metals in Zinc Solution

Question: In Sweden we have no suppliers of sodium polysulfide, Na_2S_2 or Na_2S_4. We use Na_2S(red flakes), but the purity is bad. The cost of Na_2S of higher purity is quite high. There is, however, another product which perhaps could be used for precipitating heavy metals in bright zinc plating baths. In Sweden we call it "svavellever" ("liver of sulphur," Hepar Sulfuris, Kalium Sulfuratum). It looks like liver-brown to green-yellowish lumps and consists of a mixture of potassium polysulfides. It is made of pulverized sulphur and C.P. potash. Do you think we could use this product for precipitating heavy metals in bright zinc plating?

B. D.

Answer: Any sulfide will be satisfactory for precipitating heavy metals in the zinc solution. If your red flake sodium sulfide is not very pure, filtration before use should be sufficient. Liver of Sulfur should also be filtered after dissolving but before adding to the tank.

Patents

Recently Granted Patents in the Metal Finishing Field

Metallizing Glass

U. S. Patent 2,602,032. *R. A. Gaiser, assignor to Libbey-Owens-Ford Glass Co.*

The method of producing an electrically conducting coating on a surface, which comprises applying a solution of a silicate to said surface, heating said surface to substantially its point of softening, and then applying a tin halide in fluid form.

Single Fire Enameling Process and Article

U. S. Patent 2,602,758. *T. F. Olt and J. J. Canfield, assignors to Armco Steel Corp.*

In a process of producing smooth, continuous, light colored porcelain enamel coatings on ferrous enameling sheet stock free from gas forming substances productive of pits and spots, the coatings having a high degree of adherence to the stock, the steps of imposing upon the surface of said stock a thin continuous coating of high adherence ground coat enamel of such thickness that after firing it has a thickness substantially between .0004 and .001 inch, applying at least one subsequent continuous coating of white or light colored cover coat enamel of such thickness that the total thickness of all said coats after firing is substantially .003 to 0.10 inch, drying, and firing such coats simultaneously at the firing temperature of the cover coat, the firing temperature of the ground coat being not higher than the firing temperature of the cover coat.

Corrosion Prevention

U. S. Patent 2,602,760. *J. M. Michel and K. F. Hager, assignors to the United States of America.*

The process of protecting a metal surface against corrosion which comprises forming a film on said surface by applying thereto a water emulsion adjusted to a pH value numerically less than 7 containing at least 0.1% of a material selected from the group consisting of alkyl-sulfamido-carboxylic acids, inorganic salts of such acids and organic salts of such acids, the alkyl radical of said acids having at least five carbon atoms.

Method of Plating Copper

U. S. Patent 2,602,774. *J. F. Beaver.*

In a method of electrolytically depositing copper from a copper sulfate-sulphuric acid bath containing acetyl thiourea in an amount of from about 0.005 to 0.05 gm./l. and chloride anion in an amount of from about 0.001 to 0.015 gm./l., the step of maintaining the chloride anion concentration at a constant value within the range of about 0.001 to 0.015 gm./l. by addition of a chloride.

Electrodeposition of Zinc

U. S. Patent 2,602,775. *E. I. Isherwood, assignor to Hudson Bay Mining & Smelting Co., Ltd.*

A process for the electrodeposition of zinc from a zinc sulphate solution, which comprises causing deposition of zinc from the solution with an alloy anode consisting essentially of lead alloyed with small amounts of silver and copper.

Electrolytic Method of Winning Zinc

U. S. Patent 2,602,776. *G. J. J. Mould, assignor to Hudson Bay Mining & Smelting Co., Ltd.*

In a process of winning zinc which comprises electrodepositing zinc from a zinc sulphate electrolyte, the improvement which consists in adding a sodium rosin soap to the zinc sulphate electrolyte in an amount effective to increase the current efficiency.

Abrasive Head

U. S. Patent 2,600,613. *June* 17, 1952. *G. W. Bruner and J. C. Shaffer, assignors to Vonnegut Moulder Corp.*

In an abrasive head to be driven by a driving spindle including opposed plates for mounting a series of radially-extending brushes, and an abrasive winding drum rotatably mounted about said spindle between said plates, the combination therewith of an abrasive adjusting collar having a portion thereof extending through one of said plates into rotative engagement with said drum and axially displaceable relative thereto, an annular series of teeth formed in said last-mentioned plate exposed to said collar, a corresponding annular series of teeth on said collar positioned to engage with said first-mentioned teeth for interlocking said collar and plate, and a locking nut engageable with said collar for clamping it in teeth interlocking position for securing said drum and plates against relative rotation, said collar being movable axially of said drum and plate upon said nut being backed off in spaced relation thereto for permitting disengagement of said teeth and predetermined angular displacement of said drum.

Zinc-Copper-Tin Alloy Plating

U. S. Patent 2,600,699. *June* 17, 1952. *R. E. Shockley, assignor to R. E. Shockley, Inc.*

The method of producing a corrosion-resistant plated surface on a platable article which comprises the steps of immersing in a bath comprising an aqueous solution of zinc, copper and tin salts, and containing an alkali cyanide and a caustic alkali, a cathode to be plated and an anode comprising an alloy of zinc approximately 90%, copper approximately 8.5% and tin approximately 1.5%, and passing through said bath between said electrodes, a plating current, the metal components of said salts being present in the bath substantialy in the proportions in which the corresponding metals are present in the said anode.

Buffing and Polishing Device

U. S. Patent 2,601,048. *June* 17, 1952. *M. L. Monger*

A buffing and polishing wheel including a hub composed of a pair of separable members disposed in an end to end aligned relationship, one of said

members having a cavity therein adjacent the other of said members and a passage-way communicating with said cavity and extending through one end thereof, a headed valve stem extending through said passageway and having the headed end thereof disposed within said cavity, platelike clamping elements disposed adjacent the opposite ends of said hub members, one of said elements having an opening therein through which said valve stem extends, the opposite ends of said hub members and each of said platelike elements being recessed so as to coact to provide annular recesses which are of a dovetail shape in cross section, a cylindrical flexible element surrounding said hub and plate-like elements, the peripheral wall of which is spaced from said hub so as to provide an air space therebetween, end portions extending radially inwardly from the opposite ends of said peripheral wall and including an annular portion which is of a dovetail shape in cross section and disposed within said annular dovetail recess formed in said hub and platelike elements, means interconnecting said platelike elements and clamping said dovetail portions between said elements and said hub so as to provide a sealed connection, and passageway means in said hub communicating said hub cavity with the air space between said cylindrical member peripheral wall and said hub.

Dust Collector

U. S. Patent 2,603,351. *July* 15, 1952. *W. O. Veder, assignor to Pangborn Corp.*

In a dust collector, a support, an elongated generally cylindrical chip separator rotatably mounted thereon for rotation thereabout with the axis of the cylinder substantially perpendicular to the support, a suction conduit communicating with said separator through a swiveled connection and extending axially out from the separator, a reel encircling said separator and conduit and rotatably carried by them, and a suction hose carried by said reel and communicating with said conduit.

Electrodeposition of Metals

U. S. Patent 2,603,593. *July* 15, 1952. *P. S. Blickensderfer, assignor to The Champion Paper and Fibre Co.*

Electrolytic method of closing openings in metallic surfaces, which comprises: mechanically imparting to an

opening the form of a depression whose depth is slight relative to its least width; filling any part of the opening which is deeper than said depression, with electrically conducting material; providing said depression with a continuous uninterrupted electrically conducting surface throughout its entire area; enclosing the electrically conducting surface of said depression in an electrolytic cell; electrolytically preparing the surface of said depression for receiving an adherent electroplate; thereafter electrolytically depositing metal in said depression, and maintaining during said electrodeposition a substantially continuous flow of the electroplating solution through said cell, submerging and washing over the surface of said depression.

Plating Thickness Meter

U. S. Patent 2,603,595. *July* 15, 1952. *G. H. Rendel, assignor to U. S. Steel Co.*

Apparatus for determining the amount of metal electrolytically deposited on an elongated longitudinally moving article which comprises a first circuit for obtaining a potential proportional to plating current, a second circuit for obtaining a potential proportional to article speed, a polarity sensitive potential comparing device connected in both of said circuits for comparing the two potentials, a voltage divider in one of said circuits, a movable arm for said voltage divider, a series connection between said arm and the potential comparing device, and a reversible motor controlled by said comparing device connected to change the position of said arm to balance the potentials applied to the comparing device, the position of said arm indicating the plating thickness.

Hot Dip Coatings

U. S. Patent 2,604,415. *July* 22, 1952. *M. G. Whitfield and V. Sheshunoff, assignors to Whitfield & Sheshunoff, Inc.*

A process of coating metallic strand-like elements with molten coating metal which comprises passing a strand-like element through a bath of molten coating metal and through a sizing orifice immediately into a bath of molten inert substance having a density substantially the same as that of the molten coating metal, whereby to form on the strand a uniform coating of the molten coating metal and to support said

coating in molten condition immediately after formation, and solidifying and coating while so supported.

Porcelain Enamel

U. S. Patent 2,604,410. *July* 22, 1952. *E. E. Bryant, assignor to the United States of America*

An enamel slip providing a dense strong vitreous acid-resisting coat when directly fired on metal, such characteristics being imparted thereto by the presence of from about 40 to about 65 parts by weight of silica, from about 2 to about 12 parts by weight of titanium dioxide, from about 10 to about 18 parts by weight of boron oxide and from about 15 to about 25 parts by weight of at least one substance being a member of the group consisting of Na_2O, K_2O, and Li_2O, calculated per 100 parts by weight of frit; and by the addition to said frit in the mill charge of water and from about 1 to about 10 parts by weight of clay and from about 5 to about 2 parts by weight of a member of the group consisting of silicon and ferrosilicon.

Pickling Stainless Steel

U. S. Patent 2,605,775. *August* 5, 1952. *J. C. Kientz, Jr., assignor to Superior Steel Corp.*

In the treatment of cold rolled straight chrome type stainless steel containing chromium in about the range 10-30% which has formed thereon a film of oxide such as is formed by batch annealing and which is not satisfactorily removable by pickling successively in sulphuric and nitric-hydrofluoric acids, the steps of stretching the steel by cold rolling it, thereby forming cracks in said film, and pickling the steel successively in sulphuric and nitric-hydrofluoric acids which after the first mentioned step is effective for satisfactorily removing the film.

Tumbling Machine

U. S. Patent 2,606,107. *Aug.* 12, 1952. *E. B. Banks and K. P. Tota*

A tumbling apparatus including a vessel carrier, means supporting the vessel carrier for rotation, a tumbling vessel, and means detachably securing the tumbling vessel at one end on the carrier, said last mentioned means comprising a latch, and operating means for the latch mounted on and movable relative to the tumbling vessel, said latch operating means from the outer end of the tumbling vessel.

Recent Developments

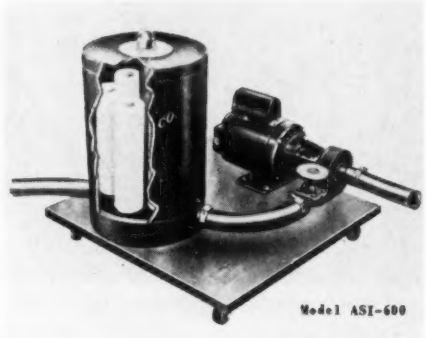
New Methods, Materials and Equipment for the Metal Finishing Industries

New Sethco Filters

Sethco, Dept. MF, 70-78 Willoughby St., Brooklyn 1, N. Y.

Sethco announces its most recent addition to its line of filtering equipment, namely Models ASI-400 and ASI-600.

These models are designed and constructed to produce sparkling filtration of practically any acid or alkaline solution from pH 1 to pH 14. The filter pump units are extremely simple and economical to operate and are priced for the most stringent budget.


Model ASI-600

The ASI series consists of two models—Model ASI-400 rated at 400-500 gallons per hour and Model ASI-600 rated at 600-800 gallons per hour.

Material of construction of pump and all fittings are stainless steel type 316. Material of construction of the filter assembly is a recently developed synthetic resin, "Sethrin" which has extreme chemical inertness and excellent temperature resistance. For example, Sethrin is resistant to sulfuric acid up to concentrations of 50%, to nitric acid up to 25%, to hydrochloric acid in all concentrations, to sodium hydroxide up to 50%, and to ammonium hydroxide up to 50%. There is no organic solvent in common use which will attack this resin at room temperature. Sethrin itself is a thermosetting resin and is resistant to heat distortion up to 220° F.

Models ASI-400 and ASI-600 are equipped with volute type centrifugal pumps and completely enclosed ball bearing induction motors for heavy duty industrial applications. All models are mounted on heavy polished bakelite panels with ball bearing rubber covered casters for easy portability. Each unit comes equipped with 12 foot lengths of chemical inlet and outlet hose.

For additional information and prices write to the above address.

Rinsing Compound for Black Oxide Finishes

Du-Lite Chemical Corporation, Dept. MF, Middletown, Conn.

A new compound which completely removes occluded salts with one rinse after the black oxidizing of metals has just been developed by this company.

Known as Du-Lite "SD," this liquid compound reacts chemically on black oxide salts which often remain trapped in rough or irregular surfaces of porous, laminated, sintered or spot welded parts. If used as recommended in a bath of from 225° to 275° F., a visible boiling results from the chemical action until all salts are removed. However, the reaction does not break down the compound, which can be re-used.

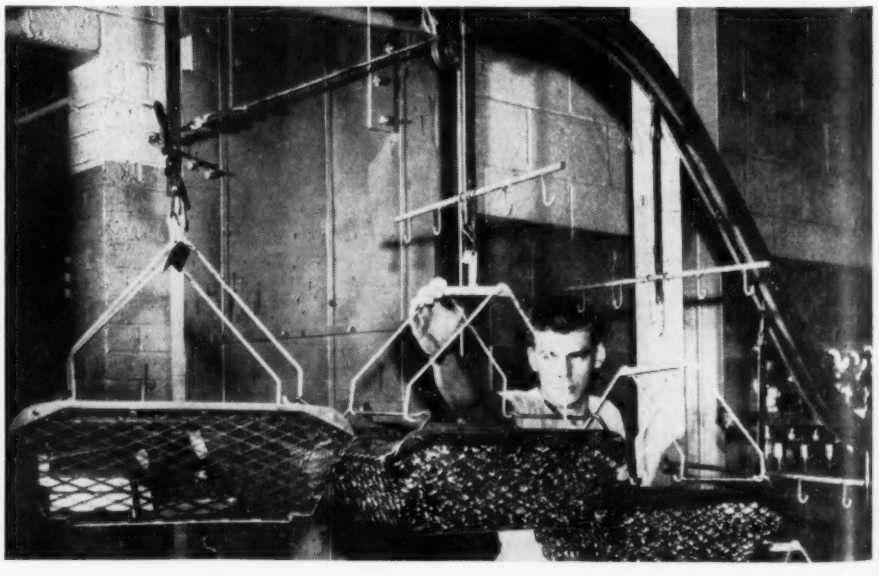
"SD" was specifically developed to overcome "creeping salts" which previously have required numerous hot and cold rinses for their removal and made the black oxidizing of laminated metals impractical. Exhaustive humidity testing of parts treated with "SD" produced no trace of occluded salts, it is claimed, nor of rust, which the light coating left by the compound also prevents.

Materials Handling System

Chas. Wm. Doepke Mfg. Co., Inc., Dept. MF, Rossmoyne, O.

The newest addition to the NesTier materials handling system has been announced by the above company. Called the NesTier Basket, it is a steel mesh basket shaped like the original NesTier box. It is designed for efficient handling and space saving during operations where small parts are being moved and dipped in chemicals, paints and other liquids.

Rust proof and corrosion resistant, the basket can be nested when not in use and tiered when filled with parts. One - quarter - inch - diameter folding handles are located at either end of the basket. When the baskets are in the tiered position, the handles form supports and items in the baskets can be removed either from the top or both ends. When the baskets are nested, the handles are flipped out of the way. Grooves on the bottom of the baskets self center for greater stack rigidity. Even when moved on a monorail con-



veyor system the basket always remains level.

Nested, the basket requires about one-sixth the space necessary tiered. It can be moved by overhead conveyors, lift trucks, hand trucks and dollies.

Available in two standard sizes, the larger NesTier Basket 220 and the smaller Nes-Tier Basket 175, both are ruggedly constructed of heavy gauge steel. The larger 220 is 16-gauge steel, weighs 14 pounds, and is 22-5/8" long, 12-½" wide and 7-¾" deep. The smaller 175 is 18-1/16" long, 9-⅛" wide and 6-3/16" deep, and weighs 5 pounds.

Alloy for Anodized Finishes

Aluminum Company of America, Dept. MF, 801 Gulf Building, Pittsburgh 19, Pa.

An aluminum alloy that will take an unusually brilliant Alumilite finish has been developed by this firm.

Alcoa C57S, as the alloy has been designated, holds great promise in the field of automobile trim, Alcoa's engineers believe. With an Alumilite coating it could be used as an attractive, economical and long-lasting replacement for chromium plating and stainless steel.

Although this is the first public announcement of Alcoa C57S, it has been used extensively in the field of giftware and refrigerator trim. From experience in these applications, a good working knowledge of the alloy has been developed.

Alumilite-treated C57S approaches high-purity aluminum in the transparency, metallic luster, and sheen of its finish, while affording substantially higher mechanical properties. It has excellent forming characteristics.

Cleaner for Zinc Die Castings

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

Oakite Products, Inc., New York, manufacturers of specialized cleaning and allied products, have announced the addition of Oakite Composition No. 95 to their line of electrocleaning materials. It is designed primarily as an electrolytic conditioner for zinc base die castings in preparation for plating.

In cleaning-conditioning of zinc base die castings, the manufacturers report Oakite Composition No. 95 as offering the following advantages: (1) *Fewer*

rejects—the Oakite Composition No. 95 anodic conditioning process removes the surface films, disturbed metal and last traces of soil that are among the major causes of peeling and blistering. It also avoids the hydrogen gas formations that raise blisters when castings are heated after electroplating. Experience with Oakite Composition No. 95, the manufacturers state, shows that no blisters appear in plating on sound surfaces during the severe test of one hour of baking at 300° F. Even in highly porous areas, heat blistering is effectively minimized; (2) *Brighter plating* — anodic conditioning with Oakite Composition No. 95 removes all films that might impair the brightness of subsequent electroplates. The controlled, uniform action eliminates under-surface shadows caused by the deep etching of harsh cleaners. Oakite Composition No. 95 rinses so freely that even with dry-down times as long as one minute—as in automatic plating —no residue films appear on the castings; (3) *No blackening during anodic cleaning*—castings do not lose their brightness during the evenly-controlled conditioning process, it is claimed.

Additional information regarding this material and data on suggested operating procedures will be made available to readers writing on company letterhead to the above address.

Miniature Circuit Breaker

Mechanical Products, Inc., Dept. MF, 1824 River St., Jackson, Mich.

"Mini-Breaker" is a new miniature branch circuit breaker that can be installed like a fuse in any standard Edison base fuseholder delivering 110-125 volt A.C. service. It requires no additional equipment and no rewiring when applied as a direct replacement on existing fuse-protected circuits of corresponding 15, 20, and 30 ampere ratings. Anyone can install it in a matter of seconds, and anyone can restore electrical service after an overload or short circuit simply by pressing in and releasing the device's shock-proof reset button.

In operation, Mini-Breaker safely interrupts excessive overloads and short circuits, tripping instantly on "shorts," but with a built-in time lag to handle temporary starting loads and line surges. While service can normally be restored within 10 seconds merely by pressing the reset button, the device is 100% trip-free and positively will

not maintain a circuit that has not been cleared. Any attempt to reset the device against an overload or short only results in increasing the speed of tripping.

Mini-Breaker has been submitted to Underwriters' Laboratories, Inc., and is said to be the only device of its kind ever to pass all U. L. tests required for listing as a "Circuit Breaker-Miscellaneous."

Mini-Breakers, in 15, 20, and 30 ampere ratings, are now in limited initial production. When commercially available it will be listed by Underwriters' Laboratories, Inc. and will bear the U. L. Reexamination Service marker as shown, according to the manufacturer.

Free descriptive literature and price information is available upon request.

Interior Coating for Vapor Degreasers

Topper Equipment Co., Dept. MF, 120 Central Ave., Clark Township (Rahway), N. J.

"Circlad," a new interior coating for vapor degreasers, has just been announced by this firm, manufacturers of Circo vapor degreasers.

The coating, applied to the walls of zinc coated degreasers has been found to double the normal life expectancy of such degreasers. It is a special coating applied over zinc-lined degreaser walls only. Normal protection from the zinc lining is achieved. In addition, double protection is afforded by "Circlad" coating over the zinc.

"Circlad" coating is supplied on new Circo zinc-coated vapor degreasers, at a very modest additional cost. Maker states this new coating is not a substitute for zinc or stainless clad degreaser

walls. It is an over-coating which increases the corrosion protection value of the degreasers.

Laboratory Planning Kit

Fisher Scientific Co., Dept. MF, 717 Forbes St., Pittsburgh 19, Pa.

Development engineers of Fisher Scientific Co. announce a kit which permits custom installations of entire laboratory rooms without blueprints, conferences.

The unique kit contains scaled cut-outs, representing 21 ready-made, pre-engineered steel furniture units. The cut-outs can be manipulated on the kit's graph paper (a half inch on the paper equals a foot in the lab room). Heights of assemblies can be allowed for just as easily as floor areas by means of the kit's booklet, which gives front and side-view dimensional drawings. Finally, even laboratory *utilities* (gas, electricity, water, cup sinks) can be marked on the plan and ordered as part of the ready-made furniture line.

Included with the kit's graph paper, scaled cut-outs and dimensional booklet is a complete catalog of unitized furniture and photographs of suggested laboratory installations. The kit is packaged in a sturdy folder and is available free upon request to the above address.

Safety Air Vent Pouring Spout

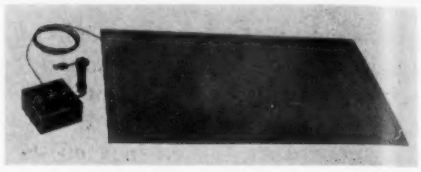
General Scientific Equipment Co., Dept. MF, 27th & Huntingdon Sts., Philadelphia 32, Pa.

The new GS safety air vent pouring spout fits any size carboy and assures a smooth even flow of acid without

spurts or splashes. The unit is made of a special acid-resistant rubber and plastic tubing for longer life, the spout has a capacity of 5 gallons per minute. Acid can't spill or splash, as a steady flow is assured, eliminating pumping or siphoning. Specially priced at $4.95.

Mat Switches and Accessories

The Recora Company, 7419 S. Western Ave., Chicago 36, Ill.



This firm announces a new line of Switchmats—extended area electrical switches in the form of sheets or thin mats. Available in any size or shape from 2″ x 2″ to 36″ x 144″, these SPST switches are actuated by predetermined pressure ranging from a few ounces to several tons. Only $\frac{3}{16}$″ thick, they can be used on floors, platforms, stair treads, etc., without obstructing foot or vehicle traffic. Foot pressure on any part of the area covered by the mat closes the circuit; release of pressure instantly opens it. Mats are hermetically sealed against moisture and weather between vinyl, rubber or neoprene. Switchmats can handle up to 1 ampere at 110 volts directly, and control the operation of high voltage high current devices when used in conjunction with the control boxes also manufactured by The Recora Company. Available controls cover types for temporary and permanent installation and provide instantaneous and delayed action. Typical uses are as versatile foot switches for various industrial and commercial electrical equipment; actuators for automatic door operators; entry alarms; automatic lighting of yards, sign and advertising displays and for many other factory, institution, commercial and commercial and home labor-saving and life-saving applications.

Safety Valve

Kelly Safety Device Co., Dept. MF, Cleveland, O.

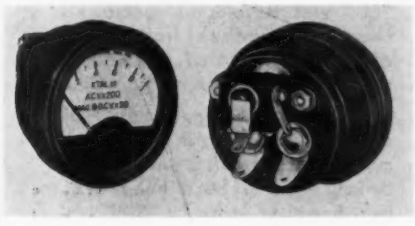
A completely new type automatic gas cut-off valve has been developed by the above company. The valve is designed for use with natural and manufactured gas, and is primarily intended to be placed on a building's gas

supply line in front of the gas meter. In event of a fire a fusible link, made of the *B. F. Goodrich Chemical Company's* Geon 404 plastic, distorts at approximately 165°F., forcing a tension spring to close the valve. This will prevent the discharge of gas from a melted gas meter.

Valves now in common use must be shut off by hand. This is often impossible to do because of the excessive heat, smoke, and fumes that accompany fire. The Kelly-Byrne valve is an automatic closing valve with ground metal to metal seating and proper openings for gas to pass through freely. The valve stem is held in an open position by the plastic link. When excessive heat comes in contact with the plastic, the link spreads, breaks, or becomes elastic enough to allow the stem to spring to its closed position, positively cutting off the flow of gas. Replacement links return the valve to perfect operating condition.

Illuminated Panel Meter

International Instruments, Inc., Dept. MF, P.O. Box 2954, New Haven 15, Conn.



This company announces the production of a new 1½" Illuminated Panel Meter. They are available in Model 150, Round Case, and Model 153, Square Case and have an external lamp housing. Company officials believe that these instruments will provide an answer to many problems involving meter illumination wherever space and weight are limiting factors.

For complete information on the illuminated meters and other International miniature and sub-miniature instruments, write to the above address.

Tape Strengthens Abrasive Belt

Behr-Manning Corp., Dept. MF, Troy, N. Y.

Where abrasive belts are to be subjected to excessive loads, they may be strengthened quickly and inexpensively with a backing of pressure-sensitive, Fiberglas-reinforced strapping tape. Investigation by the Product Engineering Department of the above firm, in-

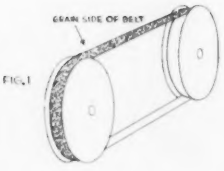


FIG. 1

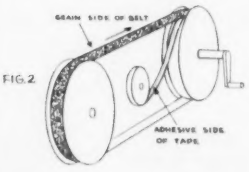


FIG. 2

FIG. 3

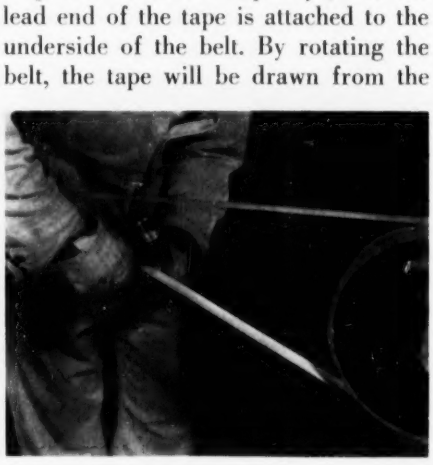
1. Place the abrasive coated belt over two flanged pulleys on which the grooves are the same width as the belt. Hold the pulleys apart to keep a tension on the belt.

2. Mount a roll of strapping tape on a spindle between the pulleys. Attach the lead end of the tape to the underside of the belt and rotate the belt and pulleys as shown.

3. Start the tape on the belt at the point most distant from the belt joint. When the belt is fully lined, cut the tape at a point that will allow about two inches overlap.

dicates that this simple modification may often permit the use of these belts for fast removal of metal and in fining operations formerly considered too severe for commercial equipment of this type.

Reinforcement is accomplished by lining the cloth side of the belt with a lamination of the pressure-sensitive tape. A simple arrangement of pulleys can be set up to expedite the job, Behr-Manning engineers report. Two pulleys are mounted in tandem and the belt to be reinforced is placed over them. A roll of strapping tape is mounted on a spindle between the pulleys, and the lead end of the tape is attached to the underside of the belt. By rotating the belt, the tape will be drawn from the



4. Polishing the flash marks from a sink trap with a reinforced abrasive belt. Notice the severe tension that is exerted in the belt as the work is pulled into it.

roll and pressed to the back of the belt as it passes over the first pulley.

In addition to increasing the tensile strength of the backing of the belts, this lamination of Fiberglas filament tape reinforces the belt joint and increases the crosswise rigidity of narrow belts ¾-in. or less in width. Thus, edge bowing and twisting are eliminated.

Replacing canvas or mattress ticking set-up belts with coated abrasive belts so strengthened does away with problems of wild grain marks, shedding and ravelling. It also reduces the annoyance of make-ready, cuts set-up time and minimizes maintenance of set-up equipment.

Metal Cleaners

Solventol Chemical Products, Inc., Dept. MF, 15841 Second Blvd., Detroit 3, Mich.

An expanded series of liquid Di-Phase metal cleaners for use in spray and dip cleaning of all types of metals during processing has been announced by this firm. The Di-Phase cleaners are added to water in concentrations of from 1% to 10% depending upon the operation and whether or not simultaneous rust protection is desired. Parts cleaned by the Di-Phase method may be stored for weeks, even under high humidity, without rusting, yet can be successfully painted, phosphate coated, etc., without further cleaning.

Di-Phase metal cleaning concentrates, baths and processes are covered by U. S. Patent Nos. 2,399,205; 2,399,267; and 2,583,165. Unrestricted licenses under these patents will be granted on request at established royalties.

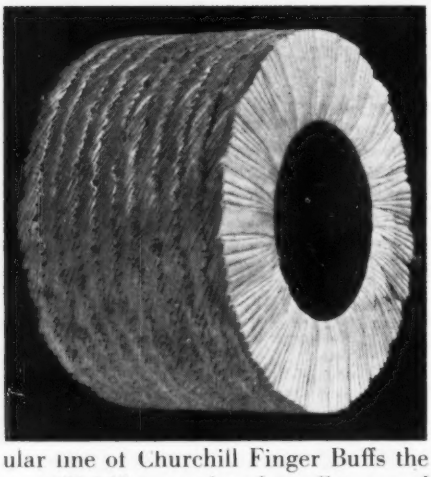
New Type Buffing Wheel

George R. Churchill Co., Dept. MF, 7513 Fayette St., North Quincy 71, Mass.

The above company has developed a new type of finger buff called the "P-30," that is claimed to be ideal for hand buffing and machine operation alike.

Each buff finger of this new type *Buff* is constructed by folding the cloth in pleats. It is this pleated construction that traps and holds the cutting compounds for all kinds of polishing and buffing requirements. Each pleated buff finger is set at the proper angle on the wheel to prevent gouging or streaking of the work.

Offered at the same cost as the reg-



ular line of Churchill Finger Buffs the new "P-30" is produced in all types of cloth and in all sizes from 6" to 18" diameters.

For further information and free samples, write to the manufacturer.

Vapor Degreaser Uses Standard Drum

Currier Co., Dept. MF, 710 - 73rd Ave., Oakland 4, Calif.

Known as the "Drum Major," an inexpensive vapor degreaser using a readily replaceable standard 55-gal. steel drum for the cleaning tank is now in production by Currier Co., Oakland, Calif.

The unit uses any of the modern vapor solvents for rapid degreasing and cleaning, eliminating the mess and hazard of cleaning with flammable liquid solvents. Condenser and heating units are externally mounted, leaving the drum interior unobstructed and providing maximum work area. Electric heating elements are beneath the drum bottom, protected from caking

or sludging in dirty solvent and from damage due to a dropped object in the cleaning tank. After long use, solvent can be recovered from accumulated sludge by simple distillation utilizing the unit's own condenser.

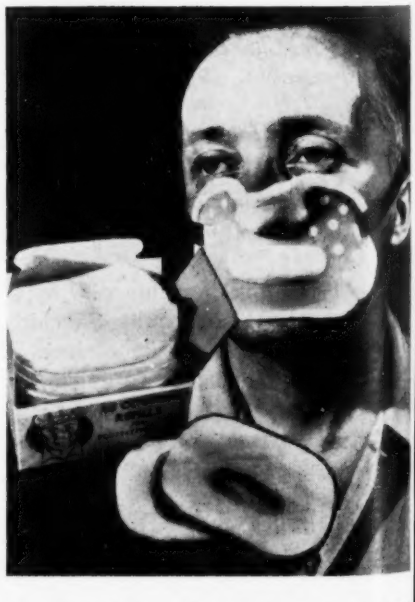
Thermostatic controls automatically maintain correct vapor level. No water connections are required; installation merely requires plugging in to a 220 v., 60 cycle a.c. power source. Elements are rated at 3500 watts. Initial solvent charge requires 5 gallons. Drum is supplied with the unit, and may be replaced when necessary with any standard 55-gal. drum.

Literature and prices may be obtained from the manufacturer.

Protective Masks

General Scientific Equipment Co., Dept. MF, 2700 W. Huntingdon St., Philadelphia 32, Pa.

G-S protective masks consist of an aluminum shield, which is held in position by an adjustable elastic head band, and replaceable laminated filters. They protect throat, nose and bronchial

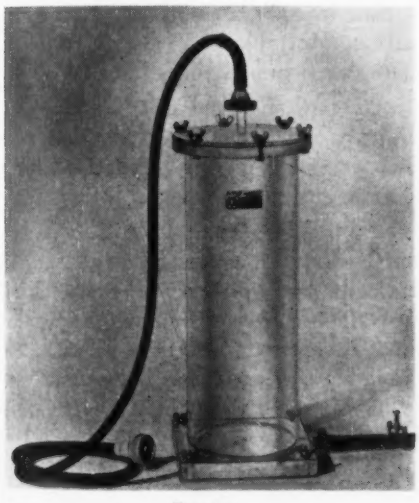


tubes from larger particles of non-toxic dusts that irritate these membranes, causing discomfort and increased susceptibility to infection.

Important from the standpoint of the wearer is the fact that these masks weigh less than ½ oz. They are cooler and more comfortable than any other type. Thus they are more frequently used and accomplish more good than masks which may cost many times as much, but are not worn consistently. The effectiveness is readily seen by filter discoloration, caused by dust as indicated in the photograph. They cost only 30c each. Refills $2.00 per 100. A package of 25 refills is 50 cents. Minimum shipment, 4 masks and 50 refills, $2.20 or equivalent. For complete information or trial order, write to the above address.

Ion-Exchanger

PUP Reactor Div., Enley Products, inc., Dept. MF, 254 Pearl St., New York 38, N. Y.



Reactor

This firm has introduced the "Pup" Reactor. The "Pup" (P.U.P. for Plastic Unit Process) is claimed by the manufacturer as capable of doing everything in ion-exchange. It is sturdily constructed throughout of high temperature Lucite and offers excellent chemical resistance plus clarity.

As a companion to the Reactor, Enley also introduces the "Pup" Regenerator Tube which facilitates easy, fast regeneration by the user. The Regenerator Tube is used by simply attaching it to the "Pup" Reactor, and also allows for backwashing of resins.

The Reactors are available in two sizes and 3 heights, and can be used individually or in series, providing a capacity up to 12,000 gallons.

One unit, including the resins for use as a water demineralizer (and which may be regenerated by the user), is priced at only $49.95. All units have glass wool at the top and bottom, and outlets of ½ inch or more tubing. They are easily secured on floor, table or other surface by use of accessories provided by the manufacturer. The top lid is removable so that the Regenerator Tube may be fastened on for immediate regeneration when necessary.

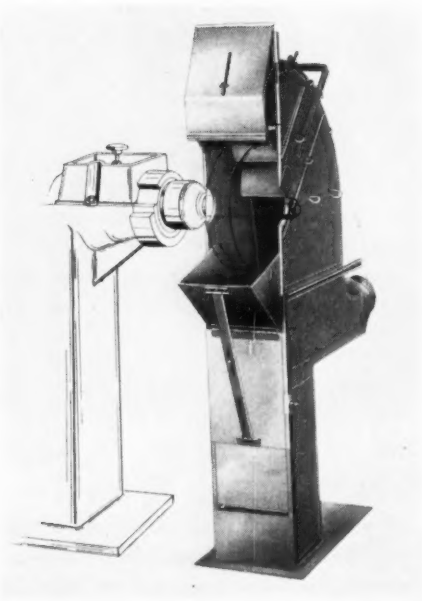
Demineralizer

Further information on uses and prices can be had by writing the manufacturer.

Exhaust Hood

Creative Development & Mfg., Inc., Dept. MF, 2222 East First St., Dayton 3, O.

A new development in exhaust hoods for buffing and polishing wheels. Curved Airfoils that can be quickly



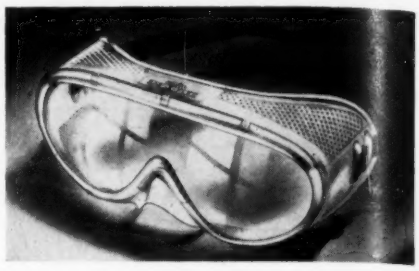
adjusted close to the surface of the buffing wheel in the hood picks up "wind" created by the revolving wheel. along with particles of metal, dirt and dust that normally follows around with the wheel, and blows it into the exhaust system with considerable velocity. This greatly increases the efficiency of the exhaust system and eliminates polishing dirt from being discharged onto the work and operator and into the plant.

The standard model shown above can be adjusted for wheels up to 16" diameter and 7" wide. It retails at $125.00. The manufacturer will also make Air-Flow hoods to specification.

Further information may be obtained by writing to the manufacturer at the above address.

Plastic Safety Goggle

United States Safety Service Co., Dept. MF, 1215 McGee, Kansas City 6, Mo.



A new plastic safety goggle trademarked SAF-I-FLEX has been developed and is now available. It is claimed by the manufacturer that through new design and using newly developed and improved materials that this safety goggle offers features of genuine comfort in wearing and extra strength and durability never available before.

A newly designed frame of pliable Vinyl has rolled edges where it contacts the face and new type grid ventilation which makes the goggle unusually comfortable and entirely fog free. The clear frame permits full side vision.

The new style lens can be easily and quickly changed. It locks securely into the frame channel at 7 different points and is optically correct.

It is claimed that the SAF-I-FLEX offers full protection from all impact hazards and that it exceeds Federal Specifications for impact resistance and strength. It will fit over even the widest type personal glasses and because of its extreme light weight (1.7 ounces) is very comfortable to wear. It is in the low price field and this plus the long life of materials used and replaceable lens, should make it very economical.

Pocket-Size Volt-Ammeter

Pyramid Instrument Corp., Dept. MF, Lynbrook, N. Y.

The Amprobe "300," a new pocket-size volt-ammeter with nine ranges up to 300 amps and 600 volts, has just been introduced. The instrument is of the "snap-around" type, which enables the user to measure current instantly without shutting down equipment or making ammeter connections and incorporates six advanced engineering and design features.

This one instrument covers nine ranges: 0-6/15/30/60/150/300 amps A-C, 0-150/300/600 volts A-C. Voltage test leads are equipped with new re

tractible safety plug, which automatically insulates itself when removed from meter. Jaws are completely insulated down into the sockets, protecting against shorts and shocks. Probe jaws are pointed for working in crowded switch and terminal boxes. No-rim window floods scale with unobstructed light from the sides. The instrument is pocket-size and belt-mounting.

Manufacturers' Literature

Electrolytic Cleaner Brochure

W. D. MacDermid Chemical Co., Dept. MF, Bristol, Conn.

The above firm has recently issued a six-page booklet on Ferrodex, a group of hi-speed electrolytic cleaners designed for rapid soil removal. A selection chart assists in choosing the correct type of cleaner for the basis metal, and detailed information is given on each cleaner.

New Chemical Brochure

The Harshaw Chemical Co., Dept. MF, 1945 East 97th St., Cleveland 6, O.

This company has issued a new booklet entitled, "Harshaw Chemicals for Industry and Laboratory." The 16 page illustrated brochure has information on the firm's plants and research laboratories, catalysts, salts, fluorides, driers, pigments, etc., giving a complete word and picture story of Harshaw's activities in the chemical field.

New Orlon Catalogue

Worklon, Inc., Dept. MF, 253 West 28th St., New York, N. Y.

This attractively illustrated 16 page catalogue shows in a group of dramatic "half-and half" pictures (half of the garment in Orlon, other half in cotton), and in actual reports, the results of extensive laboratory tests and on-the-job tests. Worklon uniforms in Orlon are completely resistant to acid, chemicals, grease, dirt, sunlight, ultraviolet rays, mildew, moths and abrasion. They launder and dry quickly, need no ironing and hold a permanent trouser crease. In addition, they outlast cotton uniforms 13 to 1, and affect cost savings of at least 80%!

Featured in the catalogue are the newest styles of men's coveralls, work shirts and trousers, laboratory coats and caps. Similar clothes in cotton are still carried, and latest additions to the line are denims for work and play, and dungarees—making it possible for the industrial wroker to have a complete Worklon wardrobe. To receive copies of this catalogue, write to the above address.

Revised "Vacuum Processing Systems Catalog"

F. J. Stokes Machine Co., Dept. MF, 5500 Tabor Rd., Philadelphia 20, Pa.

A revised editon of the 12-page catalog on "Complete Vacuum Processing Systems" has just been released by the above company. Principal changes are new sections on Vacuum Metallizing and Vacuum Furnaces.

Many types of vacuum equipment widely used in industrial processes are pictured and described in the catalog. Included are: rotary and rotating vacuum dryers, vacuum shelf dryers, freeze-drying equipment, impregnators, extraction and solvent recovery apparatus, and vacuum pumps.

Copies of the catalog, No. 730, may be obtained by writing to the above address.

Unichrome Conversion Coatings

United Chromium, Inc., Dept. MF, 100 East 42nd St., New York 17, N. Y.

Unichrome Dip and Anozinc processes for producing corrosion-resisting, chromate conversion coatings are described in literature now available from United Chromium, Inc. Unichrome Dips produce clear, yellow, olive drab, brass-color, and black coat-

ings on zinc and cadmium by simple chemical action. The Anozinc process is an electrolytic one used to produce clear, yellow, and black conversion coatings on zinc. Literature may be obtained from the above company.

Neoprene Connectors

Joy Manufacturing Co., Dept. MF, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

This manufacturer has just completed a three-color bulletin on their one-piece molded Neoprene connectors for heavy industrial applications. In it these plugs and receptacles are described as shatter-proof, watertight and highly resistant to the deteriorating effect of sunlight, oils and acid. For more details including a copy of this new bulletin (No. B41) send request to the above address.

Magnesium Finishing

The Dow Chemical Co., Dept. MF, Midland, Mich.

Magnesium Finishing, a new revision of the manual on finishing systems for magnesium products, is available from the above company.

The 128-page manual describes in detail surface stability, and surface treatment, including cleaning, mechanical finishing, chemical treatments, electroplating, painting, and assembly protection for magnesium alloy die castings, sand and permanent mold castings and sheet, plate and extrusions.

Safety First Shoe Catalog

Safety First Shoe Company, Dept. MF, Holliston 5, Mass.

A colorful new catalog, recently prepared by this firm, gives complete information about Safety First steel-toe safety shoes.

Included in the new catalog are color reproductions and cut-away drawings of new shoe styles equipped with air cushioned innersoles of genuine foam latex. These new innersoles give a degree of comfort to safety shoes not obtainable with ordinary leather innersoles.

Other portions of the catalog contain photographs and facts about the regular line of "dress" and work shoes manufactured by Safety First Shoe Co.

Dyes for Metallized Plastics

Schwartz Chemical Co., Inc., Dept. MF, 326 West 70th St., New York 23, N. Y.

How Rez-N-Dye cold-dip dye is being used by the industrial world to impart color to metallized plastics is described in a data sheet now available from this firm.

After the plastic product has already been metal coated and lacquered, a final quick dip in Rez-N-Dye adds brilliant color in seconds, according to the manufacturer.

A gleaming gold appearance can be obtained by dipping the previously plated object into yellow Rez-N-Dye. Other Rez-N-Dye colors can be used to impart a copper, antique or pastel effect. The data sheet points out that the cold-dip dye requires no heat or dilution and is available in 22 transparent colors.

The Effect of Copper Undercoats on the Protective Value of Nickel-Chromium Coatings on Steel

International Nickel, Dept. MF, 67 Wall St., New York 5, N. Y.

This booklet contains 12 pages, well illustrated and documented with tables. Gives the results of an 18 month study on high carbon steel panels plated with nickel-chromium and with copper-nickel-chromium coatings and subjected to various atmospheric and accelerated exposure tests. It concludes that, except in a carbon dioxide saturated hot water test, composite coatings of copper and nickel were inferior to solid nickel coatings of equal thickness.

New Turbidity Bulletin

Ess Instrument Co., Dept. MF, Bergenfield, N. J.

Another bulletin, of the photo-electric eye series, is now made available by the above firm.

The bulletin, No. 604, covers the Turbidity Recorder TR-6 for measuring accurately the amount of light cut off by undissolved substances suspended in fluids. Pertinent information relative to operating principles, and range of application of the turbidity instrument to main line of processing or sampling line, is included with technical sketches illustrating various chambers, indicators and recorders. The bulletin points out the total range of indicator or recorder of the Ess Turbidity Recorder is 3 parts per million on the silica scale. Copies of Bulletin # 604 available on request.

The Electrodeposition of Nickel from Nickel Chloride Solutions

International Nickel Co., Dept. MF, 67 Wall St., New York 5, N. Y.

This booklet contains 28 pages, 5 charts, 5 tables and illustrations. Compares nickel deposited from all-chloride solution with that from ordinary sulfate electrolyte and finds them of equal protective value. However, the nickel deposited from the chloride solution is of finer grain, harder, stronger and somewhat less ductile. Other advantages include indicated 50% reduction in voltage and power consumption, higher efficiencies, ease of control and wide plating range. Also smoother, tougher, more easily buffed deposits and less pitting.

Control of Dermatitis

West Disinfecting Co., Dept. MF, 62-16 West St., Long Island City 1, N. Y.

This new booklet presents a simple, inexpensive prevention and control program for guaranteeing personal cleanliness, protecting exposed skin areas, preventing clothing contamination, and guarding against special hazards. After outlining the problem, the booklet lists the conditions which should be checked to determine the cause of a case of dermatitis when it occurs. A six-page chart covering a wide range of industries lists various working conditions, types of dermatitis prevalent where these conditions exist, and suggested preventive measures for each. Brief descriptions of typical industrial skin troubles are included.

Uses of Peroxygen Compounds for Treating Metal Surfaces

Becco Sales Corporation, Dept. MF, Station B, Buffalo 7, N. Y.

The various possibilities of advantageously using peroxygen compounds in the treatment of metal surfaces are outlined in a new bulletin No. 39 recently issued by the above firm.

Peroxygen compounds useful in the treatment of metals are mainly hydrogen peroxide, persulfates and peracids. These products have found use in treatments to improve the adhesion of finishes to metal surfaces, to improve the appearance of finished articles by applying chemically produced surface films and to facilitate certain plating operations.

Four general types of procedures for treating metal surfaces with oxidizing agents are covered in the bulletin. They are: 1) producing an oxide film on the metal surface; 2) removing undesirable components of the metal surface; 3) dissolving and removing metal from a metal surface; 4) keeping constituents of certain treating solutions in the proper state of oxidation. The actual or potential usefulness of peroxygen compounds as applied to each of these four treatments is described in some detail; various examples are cited.

Copies of Bulletin No. 39, "Surface Treatment of Metals with Peroxygen Compounds," may be obtained by writing to the above address.

Dynaclone Dust Filter

The W. W. Sly Manufacturing Co., Dept. MF, 4700 Train Ave., Cleveland 2, O.

This new bulletin describes in detail the new Sly Dynaclone dust filter, designed primarily for the continuous process industries where uniform suction at all dust points is essential. It gives complete engineering data on this equipment, including details of construction, principle and application.

Included in the bulletin are hints on the engineering of dust control problems, as well as other useful engineering aids. This bulletin is a must for all industries confronted with dust problems.

Story of Modern Tin Plate

Wheeling Steel Corp., Dept. MF, Wheeling, W. Va.

The marvels of high-speed, quality production and engineering genius that turn out miles of tin plate every day for food canning and hundreds of other products are portrayed and described in a new booklet by this corporation. Mainly pictorial, the 16-page booklet shows what goes on inside Wheeling's Yorkville (Ohio) Works—a major production center for cold reduction tin plate, electrolytic tin plate, black plate, and terne plate.

Continuous annealing of steel strip, hot dipping, temper rolling, and photoelectric quality control are among the techniques contributing to sustained high quality and versatility of modern tin plate—all described in the new Ductillite booklet.

The booklet highlights a most important recent step in improved tin plate technology—the advent of electrolytic tin plate. In 1942 Wheeling placed in operation at Yorkville one of the first complete electrolytic tin plate production units. Applying a wide range of lighter coating weights of tin to a continuous cold-reduced strip, the electrolytic tinning process, in addition to conserving vital supplies of tin in critical times, has greatly accelerated production of tin plate to meet the country's almost insatiable demand for containers, caps, and closures.

Report on Use of Platecoils

Kold-Hold Manufacturing Co., Dept. MF, Lansing, Mich.

The how and why of the savings made by Platecoils in heating and cooling processes are described in detail in a new 20-page brochure just released by the above firm. The brochure shows "How Platecoils have replaced pipe coils at a savings throughout industry." It explains the savings made at the Motor Wheel Corporation, Nash-Kelvinator Corporation, Philco Corporation and ten other companies as a result of replacing pipe coils with the more efficient Platecoils. The variety of heating and cooling processes described show the diversity of application of the Platecoils.

Copies of this new brochure may be obtained by writing *Mrs. Lee S. Worthington*, Advertising Manager of the company.

Immediate Setting Floor Patch

Flexrock Company, Dept. MF, 3665 Cuthbert St., Philadelphia 4, Pa.

Repairs holes, ruts, breaks, pitted areas in concrete floors. New descriptive 4-page, 3-color folder has been designed to give all technical data.

Cathode Potential, Efficiency and Throwing Power of Nickel Plating Solutions

International Nickel Co., Inc., Dept. MF, 67 Wall St., New York 5, N. Y.

This pamphlet contains 8 tables and charts which present technical data on properties affecting throwing power for nickel chloride, hard nickel and Watts' plating solutions. Cathode potential, cathode efficiency, resistivity and metal

distribution ratios for the several baths are given and behaviors are compared. Data was obtained under same plating conditions for direct comparison.

BUSINESS ITEMS

MacDermid, Inc. Appoints W. P. Innes

W. P. Innes

MacDermid, Inc. of Waterbury, Conn., announces the appointment of *W. P. Innes* as technical director, with headquarters at the Waterbury plant.

Mr. Innes recently was employed in the *Research Laboratories Division, Electrochemistry Dept.*, at *General Motors Corp.*

He is a Captain in the Voluntary Army Reserve Corps, Research and Development Group, also a member of the *American Electroplaters Society* and *The Electrochemical Society.*

Mr. Innes is a graduate of the Michigan College of Mining and Technology and is a registered professional engineer of the State of Michigan.

Diamond Alkali Appoints Two

Managerial appointments at two important branch sales offices of *Diamond Alkali Co.* were announced recently by *W. H. McConnell*, the company's director of sales.

Effective November 1, *Earl J. Mills* will become manager of the Chicago branch sales office, succeeding the late *Charles W. Klaus*, and *John W. Kennady* will be manager of the Southwest District sales office, which has its headquarters at Houston, Texas.

Brostedt Appointed by Taylor Instrument

Russell C. Brostedt is the new manager of sales to the metal industry for the *Taylor Instrument* of Rochester, N. Y.

Brostedt has a well rounded background of 12 years experience with the Taylor organization, including the servicing of several major fields as an application and industrial sales engineer.

He replaces *J. Walter Schwarz* who recently retired from the company after 36 years association with the sales division of the business.

General Electric Appointments

E. H. Powell has been appointed assistant manager of *General Electric's* Richmond, Va., apparatus sales office, a regional sales office with branches in Norfolk and Charlottesville, Va., and Williamstown, N. C.

A native of Newell, W. Va., Powell received a B.S. degree in electrical engineering from the University of Pittsburgh in 1926. After 2 years as a student engineer in the Lynn, Mass., plant, he joined lighting sales at Schenectady, N. Y. In 1929 he transferred to Syracuse, N. Y., as a lighting specialist. In 1932 he went to Philadelphia in the same capacity, and in 1947 moved to Wilmington, Del., for general sales work. From November, 1949 until his present appointment, Powell managed the company's Trenton, N. J., apparatus sales office.

L. S. Brumgard has been appointed

manager of General Electric's apparatus sales office in Trenton, N. J., it was announced recently by the company. He will replace E. H. Powell.

A native of Littlestown, Pa., Brumgard graduated from Pennsylvania State College in 1937 with a B.S. degree. He joined the G-E organization the same year as a member of its test course. After various assignments in engineering and sales at Schenectady, Philadelphia and Pittsburgh, Brumgard transferred in 1946 to the Company's Philadelphia sales office as a cable specialist.

For the last three years, prior to his new appointment, Brumgard has been engaged in central station sales work.

Managerial Appointments at Diamond Alkali Company

Managerial appointments at two important branch sales offices of Diamond Alkali Company were announced by *W. H. McConnell*, the company's Director of Sales.

Effective November 1, *Earl J. Mills* will become manager of the Chicago branch sales office, succeeding the late *Charles W. Klaus*, and *John W. Kennady* will be manager of the Southwest District sales office, which has its headquarters at Houston, Texas.

The Chicago office supervises Diamond sales activities in a nine-state area comprising Illinois, Indiana, Iowa, Michigan, Minnesota, Wisconsin, Nebraska, and the Dakotas. The Southwest District embraces the states of Texas, Oklahoma, and Kansas.

The move will return to Chicago a sales executive well-known in that area. From 1945 until 1949, Mr. Mills was manager of less-carload sales for Diamond at its Chicago office.

Mr. Mills, who is 51, is a veteran member of Diamond's Sales Department. Throughout his many years with the company in sales, service, and supervisory capacities, he has covered the country extensively and has built up a wide acquaintanceship in the chemical and allied fields.

The new manager of the Southwest sales office, Mr. Kennady, is 42. He comes to the Diamond sales organization from *Kolker Chemical Works, Inc.*, a Diamond subsidiary, which he has been serving as district manager at Kolker's Houston plant.

Whitfield Chemical Co. Appoints Grosser

Herman G. J. Grosser

The *Whitfield Chemical Co.*, Detroit manufacturers of metal cleaning and finishing chemicals for the industrial and ordnance fields, announces the appointment of *Herman G. J. Grosser* as Cleveland District sales manager. Mr.

Grosser was formerly Ohio sales representative.

The W. D. MacDermid Chemical Co. Appoints Tiers

Robert H. Tiers

This firm announces the appointment of *Robert H. Tiers* as chief chemist for the company.

Mr. Tiers is a graduate of the University of Connecticut with a B.S. degree and has taken graduate training in heat treating, metallurgy, electroplating and surface chemistry at the University of Connecticut Extension School as well as the University of Pennsylvania. He was employed from 1933 until 1944 by *Pratt & Whitney Aircraft Division* of *The United Aircraft Corp.*, beginning as control chemist and advancing to an advisory position on the general manager's staff. From 1944 to 1952 he was employed by the *Pennsylvania Salt Mfg. Co.*, eventually heading the research and development administrative staff, pertaining to the development and manufacturing of the metal cleaning division.

In his present capacity he will supervise experimental and development work at the company's laboratory, and also will be available for consultation and service work in the field.

Harry C. Martin Elected Carborundum Vice-President

Harry C. Martin, director of research and development of *The Carborundum Co.*, has been elected a vice-president of the company, it was announced today by *Clinton F. Robinson*, president.

A graduate of the University of Toronto, where he obtained his Bachelor of Arts and Master's Degrees in chemistry and mineralogy, Mr. Martin joined Carborundum's research laboratory in 1913.

About a year later he was placed in charge of the Company's silicon foundry operations. Mr. Martin was then transferred to the Coated Products Division as control and product engineer, to establish standards and specifications for raw materials and finished products and subsequently assumed duties in connection with rubber and shellac bonding materials.

In cooperation with the late F. J. Tone, former president of The Carborundum Company, Mr. Martin conducted extensive research on resin bonded fiber discs. A patent covering this work was recently granted. Mr. Martin was appointed assistant technical director in 1944 and promoted to technical director three years later.

A native of Napanee, Ontario, Canada, Mr. Martin is a member of a number of technical societies, including the American Chemical Society, American Ceramic Society, and the Industrial Research Institute.

Diamond Alkali Forms Two Subsidiaries

Diamond Alkali Company, one of the nation's leading producers of basic chemicals, announced recently that it had formed two new subsidiary companies to handle its rapidly-increasing volume of export sales.

The new concerns, both incorporated in Delaware, commences their activities September 1. *Diamond Alkali Inter-American Corp.* is the sales outlet for Diamond chemicals in Latin-America and other countries in the Western

Hemisphere outside the United States; and *Diamond Alkali International, Inc.*, serves all other areas of the world.

Offices and facilities of both new companies will be at 122 East 42nd St., New York City. *S. S. Savage* has been elected president of the new export companies.

Hollingshead Corp. Merges Government and Industrial Sales Divisions

The merger of the Government Sales Division and the Industrial Sales Division of the *R. M. Hollingshead Corp.*, has been announced by vice-president in charge of sales, *Donald O. Severson.*

Frederick H. Lee, Jr., formerly sales manager of the Industrial Division has been appointed manager for both the Government and Industrial Divisions.

William L. Carolla, formerly assistant sales manager of the Industrial Division, has been named sales manager of that division.

John W. Reed, Jr., formerly west coast representative for the Industrial Division, has been named sales manager of the Government Sales Division.

Officials of the Hollingshead Corporation, a leading manufacturer of maintenance chemicals, are effecting the merger in order to combine all the sales of bulk items under one division.

Dr. C. Fred Gurnham Appointed by Michigan State College

Dr. C. Fred Gurnham is the new head of the Department of Chemical Engineering at Michigan State College, East Lansing. His appointment was effective July 1.

The 41-year-old chemical engineer has more than 20 years of experience in industrial and educational capacities. He came to M.S.C. from Tufts College, Mass., where he had headed the chemical engineering curriculum for four years.

Dr. Gurnham received his B.S. degree from Yale University in 1932 and his M. Ch. E. and Eng. Sc. degrees from New York University in 1940 and 1942, respectively.

He has worked as an assistant professor of chemical engineering at Pratt Institute; as chemical engineer for the *Whitney Blake Co.* and other industrial concerns, and as an engineering consultant. He is a licensed professional engineer in New York, Connecticut and Massachusetts.

Dr. Gurnham is a member of numerous professional organizations, including the American Chemical Society, American Institute of Chemical Engineers, American Society of Engineering Education, National Society of Professional Engineers, Sigma Xi and Tau Beta Pi. He has contributed several articles to professional journals in the chemical engineering field. He is particularly interested in the treatment and disposal of industrial wastes, and is a member of the President's National Technical Task Committee for industrial wastes and of industrial wastes and of industrial waste committees of A.I.Ch.E., American Electroplaters Society and American Association of Textile Chemists and Colorists.

Johns-Manville Offers Film

Johns-Manville recently completed a 16 mm, 36 minute, sound film in full color covering its diatomaceous silica products called Celite.

The title of this motion picture is *"Celite, The Story of How Johns-Manville Puts the Diatom to Work."* It explains how the Celite diatomite deposit was created over five million years ago . . . how the company mines this unusual material and converts it into usable forms . . . and how the unique properties of Celite are put to work. The camera takes you into various industrial plants where Celite is used as a filter aid . . . shows some of the ways in which Celite mineral fillers improve products and processes . . . and

points out other interesting Celite applications.

This film may be borrowed without charge from any of the 17 Johns-Manville sales offices located throughout the United States and Canada.

Pennsalt Names McWhirter Wyandotte Works Manager

James M. McWhirter formerly Southern works manager for the *Pennsylvania Salt Mfg. Co.*, has been appointed manager of the Wyandotte Works, it was announced recently by *W. F. Mitchell*, vice-president.

Mr. McWhirter replaces *G. A. Nelson*, who, because of his wide background and experience in electrochemical engineering, is being assigned to general engineering and consultative work in connection with Pennsalt's current expansion and plans for future developments.

Mr. McWhirter, while a newcomer to Wyandotte, has had broad experience with the company and in industry. Coming to Pennsalt from the General Chemical Co. in July, 1945, he was assigned first to the Natrona, Pa., plant. He was named superintendent there on January 1, 1946. He assisted in engineering Pennsalt's hydrofluoric and sulfuric acid operations at Calvert City, Ky., and became the first superintendent of that plant when it began operations in June, 1949. He later was named Southern Works manager, having supervision of Pennsalt plants at Calvert City; Montgomery, Ala.; and Bryan, Tex. Ritner W. Tomlinson was named to succeed him as superintendent at the Calvert City plant.

It was also announced that *Herman J. Eichenhofer*, formerly assistant superintendent at Wyandotte, has been named superintendent of Pennsalt's new electrolytic chlorine, caustic soda and hydrochloric acid plant, now under construction at Calvert City.

J. T. Gormaliy, formerly superintendent of the Cornwells Heights plant, was appointed assistant to the production manager and will make his headquarters in the Philadelphia office. *Frank J. Power*, assistant superintendent, becomes acting superintendent at Cornwells Heights.

Sterling Electric Motors, Inc. Appoints Herbert F. Ziegler, Jr.

The appointment of *Mr. Herbert F. Ziegler, Jr.* as manager of the Kansas City, Missouri District Office of *Sterling Electric Motors, Inc.* has been announced by *Mr. Alan J. Bronold*, Sterling's Vice-president of Sales.

Mr. Ziegler is a native of Kansas City and is a graduate of Notre Dame University. After service in World War II as Lieutenant j.g. in the Navy, he took post-graduate work at the University of Friborg in Switzerland. Since that time he has gained wide and varied experience in industrial sales and is prepared to render motor application service to the industrial needs of the area.

The Kansas City district office address is 1207 Grand Ave., Suite 838-40.

Mr. Bronold, also announced appointment of the following additional distributors.

Cascade Industrial Supply, Inc., 515 Market St., Klamath Falls, Ore.

Selma Foundry & Machine Co., P.O. Box 662, Selma, Ala.

W. S. Wilson Corp., 11 So. William St., New York 4, N. Y.

Roger Brown Company, 111 E. Missouri, El Paso, Tex.

Herr Electric Company, 410 W. Conway St., Baltimore 30, Md.

Story Electric Motor Repair Co., 269 Paterson Ave., Little Falls, N. J.

Woodbury & Company, 133 S. W. 2nd Ave., Portland, Ore.

Kingsley Appointed by Carborundum Co.

The appointment of *William J. Kingsley* as assistant general sales manager of *The Carborundum Co.*, has been announced by *F. J. Tone, Jr.*, vice-president, sales. In his new position, Mr. Kingsley will assist the general

sales manager in all general sales activities of the company.

Mr. Kingsley has been with Carborundum since 1922, when he joined the sales engineering department. He transferred to the sales department in 1936 and covered the Syracuse, N. Y., area until 1950, when he became assistant sales manager of the Bonded Products and Grain Division.

Before joining Carborundum, Mr. Kingsley was employed by the *H. H. Franklin Manufacturing Co.*, Syracuse, where he obtained practical plant experience in grinding techniques.

A native of Syracuse, Mr. Kingsley attended elementary and vocational school there. He now lives with his family in Snyder, N. Y.

Belke Scholarships Awarded

Two Chicago youths have been awarded the first scholarships in the recently established *Belke Mfg. Co.*—Northwestern University cooperative training program. *Robert Blumenthal*, age 19, and *Gerald P. Glab*, 18-year-old son of *Paul Glab*, secretary of the *Chicago Branch* of the *American Electroplaters' Society*, will begin the 5-year program in September at the Technological Institute of the University in Evanston, Ill.

On completion of the program, the boys will be the first recipients of the new Bachelor of Science Engineering degree, which has been initiated at Northwestern in connection with this cooperative education plan. Over the 5-year period, the award winners will spend 12 quarters at school studying various engineering subjects, and 6 quarters getting practical experience in local job plating shops, in manufacturing plants with large metal finishing departments, and in the Belke plant.

Gerald P. Glab

After the first year and a half, the students will be practically self-supporting as they will be paid prevailing wage rates while working in industry.

Glab ranked third in his June 1952 class at Crane Technical High School, and was active in many student activities. Blumenthal, a June 1952 graduate of Chicago's Austin High, was 75th in a class of 575, and spent his after school hours and vacation time working in various jobs to help support his family.

Officials of Belke and the University believe these scholarships will go a long way in solving the critical shortage of trained men in the Electroplating and Metal Finishing Industry.

Magnus Chemical to Distribute Long Life Product

The Marine and Power Plant Service Division of *Magnus Chemical Co., Inc.*, Garwood, N. J., has been appointed by *Long-Life New York* as distributors of their product Long-Life. Long-Life is a commutator and slip ring protector which extends the life of commutators, slip rings and brushes. It is a paste containing degummed castor oil, refined oils and tallows and copper dust in colloidal suspension.

When Long-Life is applied to commutators, slip rings and brushes it changes to an extremely hard film. Part of this film is picked up by the brush, or between the slip ring and brush. The film is oil and dustproof

and its hardness eliminates stoning and cleaning.

Pittsburgh Plate Glass Appoints Schweppe

Appointment of *John V. Schweppe* as production superintendent at the

John V. Schweppe

Shelbyville, Ind. Fiber Glass producing plant has been announced by *J. Hervey Sherts*, general manager of *Pittsburgh Plate Glass Co.'s* new Fiber Glass Division.

Associated with Pittsburgh Plate Glass Co. since 1946, Mr. Schweppe had served as a supervisor in the tank department at the firm's Creighton, Pa. plant.

A native of Tarentum, Pa., Mr. Schweppe is a graduate of Washington and Jefferson College with the degree of B.S. in chemistry. Prior to joining Pittsburgh Plate, Mr. Schweppe had four years World War II service as a Lieutenant Commander with the U. S. Navy.

James A. Rabbitt Retires From International Nickel

James A. Rabbitt, Inco Consulting Engineer, and an authority on Japan and the Far East retire from active service with The *International Nickel Co., Inc.*, on August 31, *Dr. Paul D. Merica*, President of the company, announced recently.

The services of Mr. Rabbitt, who has been with Inco for more than 22 years, will continue to be available to the company in an advisory capacity on Far Eastern affairs. Mr. Rabbitt, a native of Stamford, Conn., was 75 on August 6.

He is the author of several publications on nickel alloys in various industries and has written many articles for the press and periodicals in China, Japan and the United States on Japanese industry. He also wrote "Ballads of The East" (1937) and "China Coast Ballads" (1938).

Mr. Rabbitt is a member of the American Club, Tokyo; Engineers' Club, New York; American Chemical Society; American Faraday Society; American Society of Mechanical Engineers (Fellow 1947, Life Member 1949); American Institute of Mining and Metallurgical Engineers; Mining Society of America; American Electrochemical Society, and The Iron and Steel Institute, London, England.

Tin Research Institute

The International Tin Research and Development Council has resolved that it will in future be known as *The International Tin Research Council*. This change will not affect the policy of the Council or alter its current activities.

Kaiser Aluminum & Chemical Sales, Inc. Appointments

Three new sales staff appointments were announced recently by *Bert Inch*, vice-president in charge of sales, *Kaiser Aluminum & Chemical Sales, Inc.*

Richard E. Hanson, manager of the firm's Kansas City district office, was named assistant to *John E. Menz*, general sales manager, in the company's Chicago general sales office.

In the firm's field sales organization *Wallace A. Davidson* was appointed manager of the Kansas City office and

Donald F. Sheridan became branch representative of the Wichita, Kansas sales outlet. The Wichita office operates as a branch sales office under the firm's Kansas City headquarters.

N.P.A. Appoints Shanaman

Appointment of *LeRoy M. Shanaman*, Portland, Oregon, as chief of the Inorganic and Agriculture Chemicals Branch of the Chemical Division of the *National Production Authority*, Department of Commerce, was announced recently by *Dr. George E. Holbrook*, Director of the Chemical Division.

Mr. Shanaman succeeds *Mr. John McMullen*.

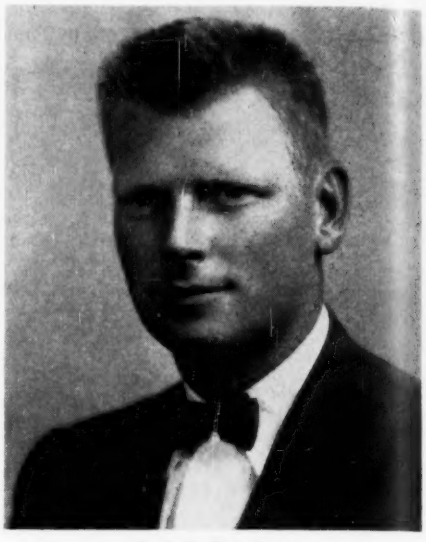
Mr. Shanaman was graduated from the University of Oregon in 1933 with a Bachelor of Science degree. For the past 17 years, he has been associated with the *Pennsylvania Salt Manufacturing Co.*, manufacturers of chemical salts.

Mr. Shanaman is on leave from his position as sales manager with the Pennsylvania Salt Manufacturing Company of Washington situated at Portland, Oregon. He is serving the Government without compensation.

During the war, Mr. Shanaman was a lieutenant in the Navy and saw duty in the Pacific.

United Chromium Adds Another New England Representative

Jack S. Brundage has joined the New England sales and service staff of the Organic Coatings Division of *United Chromium, Inc.* Mr. Brundage, a member of the New Haven Branch of the American Electroplaters' Society, will sell and service the complete line of Unichrome Lacquers, Enamels, and Synthetics with particular emphasis placed on clear coatings for bright metal finishes.



Jack S. Brundage

A lifelong resident of Stamford, Conn., Mr. Brundage was an employee of the *Zapon Division* of the *Atlas Powder Co.* from 1936 until June of 1952. He rose from laboratory assistant to coatings formulater and chemist in 1939. From April 1941 to March 1946 he served in the U. S. Army, rising from the rank of private to captain in the Field Artillery. Upon release from the Army, Mr. Brundage returned to Zapon as a sales engineer and held that position until joining United Chromium.

Sipi Metals New Name for Silverstein & Pinsof

Effective September 1, 1952, *Sipi Metals Corp.* is the new name for *Silverstein & Pinsof, Inc.*, well-known Chicago smelters and refiners.

The business was founded in 1912. Operations, through the years, were progressively enlarged and a major move made to the present location at 1720 Elston Ave., Chicago.

Sipi Metals Corp. produces a complete range of non-ferrous alloys, including brass, bronze, aluminum, lead, tin, solder, shot alloys, anodes, babbitt, zinc base alloys, copper and nickel alloys. Field of service also include Type Metal for the printing trade, zinc, copper and other non-ferrous alloys for electroplating, lead for the plumbing industry, and die casting alloys. In 1950, the firm was appointed warehouse distributors of Reynolds aluminum pig and ingot.

U. S. Stoneware Appoints Kiernan

Howard Farkas, Executive Vice-President and General Sales Manager of the *U. S. Stoneware Co.*, Akron, O.,

Frank J. Kiernan

has announced the appointment of *Frank J. Kiernan* as sales engineer.

Mr. Kiernan holds the degree of Bachelor of Science in Chemical Engineering which he received upon completion of a five-year cooperative course at the University of Detroit.

He is a junior member of the American Institute of Chemical Engineers and Chemical Engineers of Greater New York.

Mr. Kiernan has had wide experience in chemical processing, having specialized in the field of organic and fine chemicals for a number of years. His work in pilot plant and semi-works production, plus research and development has given him a thorough knowledge of the process industries and related problems.

Mr. Kiernan has made his headquarters in U. S. Stoneware's New York office at 60 East 42nd Street.

Bohn Aluminum Appoints McCullough

Raymond C. McCullough has been named divisional sales manager of *Bohn Aluminum and Brass Corp.*, according to an announcement by *Terry W. Kuhn*, vice-president.

McCullough has been serving Bohn as district sales manager of the Chicago office and will now make Detroit his headquarters.

He joined Bohn in 1949 and prior to that time had been associated with *Reynolds Metal Co.* and *Kaiser Aluminum and Chemical Sales Corp.*

It was also announced that *Richard C. Aylward*, a Bohn sales representative has been named manager of the Chicago office to fill the vacancy created by McCullough's promotion.

Kopecki Joins Carborundum

Ernest S. Kopecki has joined the Public Relations Department of *The Carborundum Co.*, Niagara Falls, N. Y., it was announced by *E. Dent Lackey*, Public Relations Manager.

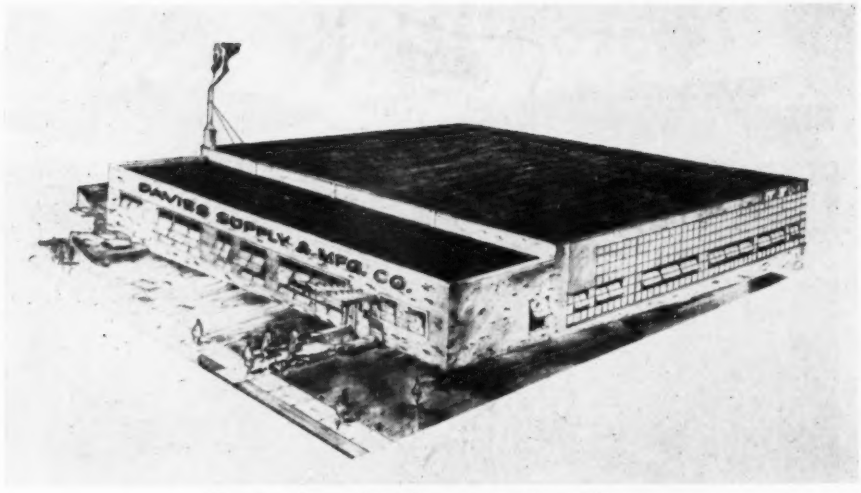
As Assistant to the Public Relations Manager, Mr. Kopecki's responsibility will be to conduct editorial relations with the industrial trade press.

Coming to Carborundum with varied and extensive experience in the field of metallurgy, Mr. Kopecki earned his Bachelor of Science in Chemical Engineering at Marquette University, Milwaukee, and his Master's degree in Metallurgy at Carnegie Institute of Technology, Pittsburgh.

Mr. Kopecki served with the U. S. Navy's Bureau of Ordnance during the war and was separated from service as a Lieutenant Commander. In 1945 he joined the staff of "The Iron Age" where he subsequently assumed the position of metallurgical editor.

He has been associated with the *Pennsylvania Salt Manufacturing Co.*, Philadelphia, for the past several years—first as sales service representative and later as assistant manager of public relations.

Mr. Kopecki has been active in a number of technical and trade societies, and is a member of the American Society for Metals.



Davies Supply Moves to New Plant

Davies Supply and Mfg. Co., leading Southwestern supplier of industrial plating and polishing equipment and materials, moved early in September into an ultra-modern new home especially designed and constructed for the Davies firm at 4160 Meramec St., St. Louis 16, Mo.

Besides the general offices, the new structure contains over twice as much warehouse and shop space as Davies' former quarters at 2315 Delmar Blvd., St. Louis. *L. A. Davies*, president, states that the extra warehousing space will permit even better service than in the past on the numerous nationally-known lines of plating and polishing equipment and materials for which Davies is Southwestern sales and service representative.

In addition, the enlarged shop space will permit the expansion of Davies' present production of plating racks and tanks, to include various other types of plating equipment which will be designed and built by the company in the future.

The new telephone number of the home office in St. Louis is MOhawk 9332. The address and phone number of Davies' branch office in Dallas remain unchanged; 301 North Market St., Dallas 1; telephone PRospect 5423.

Hooker Opens Chicago Office

Hooker Electrochemical Co. is opening a new sales office at One North La Salle St., Chicago, according to an announcement by *R. L. Murray*, President. *Charles Y. Cain*, Hooker's sales representative in the Chicago area since 1945, has been named district sales manager, and *Donald McKechnie*, who has been in the company's main office for several years, will be Chicago office manager.

Location of the new office in Chicago, the announcement stated, will enable Hooker to better serve its customers in this territory and enjoy a larger participation in the rapidly growing market for chemicals in the Midwest.

The new $12 million Hooker caustic

soda chlorine plant now under construction at Montague, Mich., near the shores of White Lake, will be the closest producing plant of its kind to the Midwest market and will result in substantial savings through reduced delivery costs to consumers of these products, the announcement stated.

Rapid Electric Celebrates Ten Years in the Rectifier Business

Christmas came again in July for employees of *Rapid Electric Company*. The company marked the completion of ten years in the rectifier industry by holding a dinner-and-dance party on July 3. One of the many pleasant surprises of the evening was the distribution of a mid-year bonus.

Rapid Electric's history goes back to World War II, when its first products were DC power supplies for electronic equipment. After the war, the company was among the first to see the possibilities of the selenium rectifier as a source of DC power for electroplating. Accordingly, Rapid set its course in that direction, and has since specialized in the design and manufacture of plating rectifiers and their associated controls.

Ten years is a long time in a young industry like that of the selenium rectifier, and each of those years has seen startling advances in manufacturing techniques, in unit capacities, in features of design. Rapid Electric's tenth-anniversary celebration was, in a way, a recognition of the contribution which its staff has made to the company, and through the company to the industry as a whole.

Carl R. Sare Elected Vice-President of Sly Mfg. Co.

Carl R. Sare, formerly assistant to the president of the *Patterson Foundry & Machine Co.*, East Liverpool, Ohio, has been elected vice-president of *The W. W. Sly Mfg. Co.* and assumed his duties Sept. 1st. it was announced by *Frank W. Klatt*, president of Sly.

Sare attended the University of

Pittsburgh and Penn State Extension College. He was employed by Jones & Laughlin Steel Corp. in Pittsburgh before joining Patterson. With Sly he will be primarily concerned with promoting dust filter sales.

Sly, at 4700 Train Ave., Cleveland,

Carl R. Sare

Ohio, was founded by W. W. Sly in 1874. Directors in addition to President Klatt include *Mrs. Marie Sly*, *Walter J. Carey* of *Gunn, Carey & Co.*, investments; *John L. Pischke*, vice-president-treasurer, *American Mono Rail Co.*, and *Isaac Stickney*, attorney.

Tacoma Boy Wins Pennsalt President's Scholarship

Philip H. Fisher, son of *Harry S. Fisher*, a chemical engineer at the Tacoma plant of the *Pennsylvania Salt Manufacturing Co.*, of Washington, has been awarded the 1952 college scholarship provided by *George B. Beitzel*, Pennsalt president.

Mr. Beitzel makes one such award each year to a son or daughter of a Pennsalt employee who is selected by an independent board of educators. The scholarship committee this year consisted of *Dr. James Creese*, president of Drexel Institute of Philadelphia, and *Dr. Arnold K. Henry*, dean of student affairs at the University of Pennsylvania.

The scholarship provides $300 a year for four years of study toward a bachelor's degree at an accredited college or university. This year's recipient, who is a graduate of Federal Way high school at Redondo, Wash., attained very high grades in high school, especially in mathematics and science course, and has applied for admission to the University of Washington where he intends to study electrical and radio engineering.

Carney Honored by Metals Disintegrating Co. for Twenty-Five Year Service

Elvin P. Carney

Elvin P. Carney, Chief Control Chemist of *Metals Disintegrating Co., Inc.*, Elizabeth, N. J., manufacturers of metal pigments, metal powders and

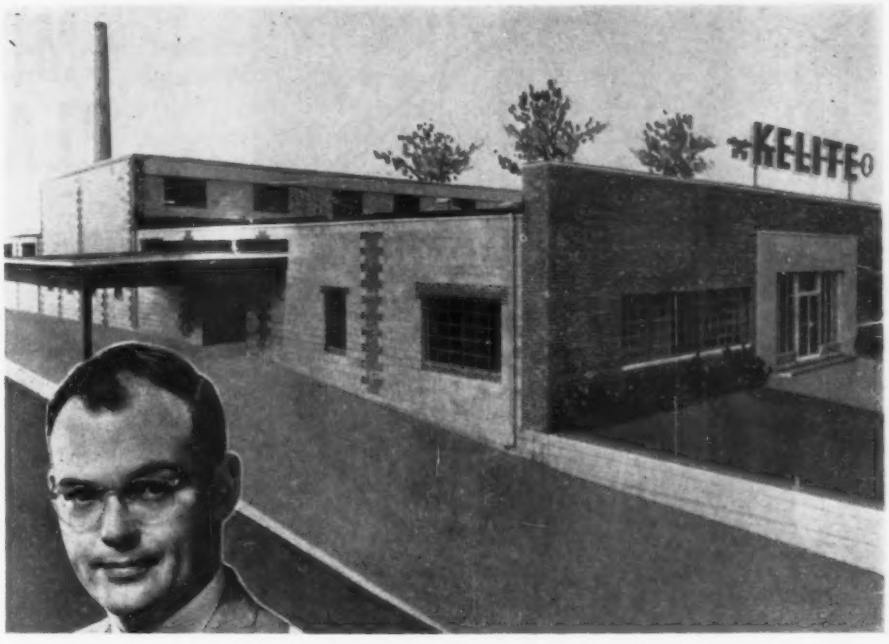
metal abrasives, was the guest at a dinner held in his honor, celebrating his twenty-five years of service with the company.

The affair, held on Wednesday evening, September 10th, was a gala one, attended by over fifty of Mr. Carney's associates and the executives of the company. Highlight of the evening was the presentation by *Mr. H. E. Hall*, president of the company, of a gold watch, suitably inscribed, which was given to Mr. Carney.

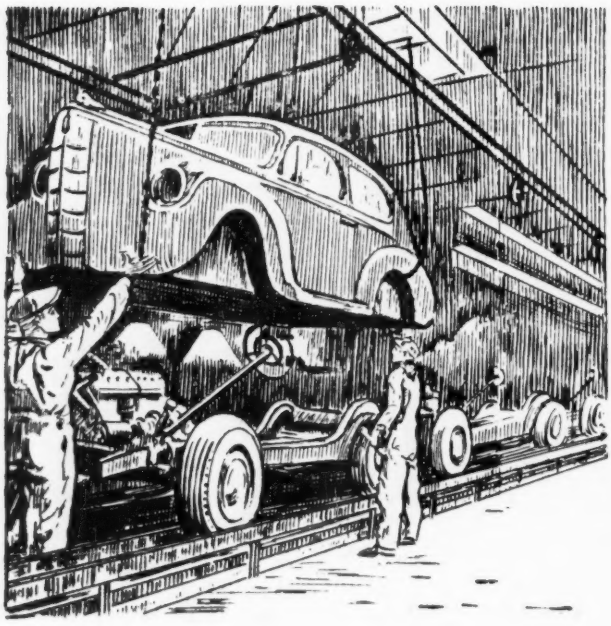
In commenting on the occasion, Mr. Hall recalled Mr. Carney's quiet yet efficient manner of carrying out the assignments of his department, of the high regard in which Mr. Carney is held by many customers and others in the industry, for his untiring efforts in obtaining the highest degree of accuracy in his product analyses.

Prior to his joining the MD organization, Mr. Carney was a chemist for a number of years with the *National Lead Company*. A graduate of Pratt Institute, he is a member of the American Chemical Society, the American Society for Metals and the Electrochemical Society.

Sorensen Heads New Kelite Plant in Berkeley Heights, N. J.



Kelite Products, Inc., manufacturers of cleaning and processing compounds and steam cleaning machines, has completed its new factory and sales offices at Berkeley Heights, N. J. The inset shows *William Sorensen*, Vice-President in Charge of Manufacturing and Sales for the Atlantic Division. Headquarters of Kelite are in Los Angeles with additional plants in Chicago and Dallas, and Service Offices in 86 principal American cities and 15 countries abroad.



MOTOR CITY PLATING NEWS

by

Edward Finne

Tiedeman Elected to Board of Directors at Wagner Bros.

Wagner Brothers, Inc., Detroit manufacturer of plating anodes, electroplating rectifiers and equipment, has elected *O. H. Tiedeman* to the Board of Directors as Vice-President in Charge of Sales, according to an announcement by *Joseph Wagner*, President. Mr. Tiedeman joined the company in 1947 as a sales engineer handling the *Wagner-Tiedeman Electroplating Rectifier* which he developed. Since then, Tiedeman has been Chief Engineer and Operations Manager. Under his direction, the production and promotion of electroplating rectifiers became a major activity of the company.

Mr. Tiedeman came to Wagner

O. H. Tiedeman

Brothers from *Radio Controls, Inc.*, New York, where he was Chief Engineer. Previous to this he was with the U. S. Army Signal Corps Development Laboratories at Fort Monmouth, N. J. He received formal training at Pratt Institute.

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The *Plating Institute of Michigan* held its first meeting of the year at the Pilot House in Detroit on Tuesday, Sept. 9, 1952.

The meeting was very well attended and following dinner, the business session was opened by *Robert Huber*, President, who presented *Ray Shock*, executive secretary of the *National Association of Metal Finishers*, who has been absent from Detroit for the past 5 months working in Washington at the new NAMF headquarters. Ray gave a comprehensive resume of his activities in behalf of the organization in the Washington area.

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Auto City Plating Co. of Detroit has appointed *O. A. Helser* as director of industrial relations, a field in which he has worked for 16 years.

Robert Wilson, chemist with the company for the past three years has been transferred to the sales staff.

Auto City is now devoting about 15% of its production to defense work, a figure which *H. E. Adelsperger, Jr.*, President, said probably would double by January 1st.

The company is specializing in precision silver plating on aircraft parts and precision hard chrome plating on aircraft and other defense items.

The *Nelson Chemicals Co.* has developed a cold cleaning process for metals which rustproofs simultaneously, *Harold R. Nelson*, President, announces.

Developed by *Dr. Orlan M. Arnold*, research director, the process operates at room temperature and eliminates fire and toxic hazards and gives excellent bonding properties, enabling the metals to be painted after cleaning without further preparations.

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Wyandotte Chemicals has promoted three of their sales organization to new positions, *Bert Cremers*, vice-president in charge of sales announces.

Howard F. Roderick was named director of sales, administrating sales and technical service of the *Michigan Alkali Division*. Roderick was formerly director of Wyandotte's research activities and has been with the company for 21 years.

M. E. Clark has been elevated to general manager of product sales. He will co-ordinate sales programs on the various Wyandotte products and be liaison between manufacturing and

sales. Clark was recently manager of alkali and chlorine sales.

M. A. Thompson, formerly Chicago branch manager, was moved to direct field sales from Chicago and carries the title, general manager of field sales.

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Detroit now appears to have a manpower shortage as opposed to the job shortage of a few months back. Approximately 20,000 more workers are needed between now and the first of the year to meet what may be the all time high in employment. The total employment is now within a hairbreadth of the high reached in Detroit in 1943.

The reason for the need of manpower seems to be the all out production race by the automobile companies to make up for losses suffered during the recent steel strike.

As an indication of the needs—Ford needs 1500 men of whom 20% must be skilled and the remainder unskilled for heavy work. Chrysler hopes to hire 5000 additional workers. Packard Motor needs 7000 employees by the end of the year for its jet and marine engine program. Kaiser-Frazer needs about 1000 aircraft workers for its Willow Run plant. General Motors needs engineers, draftsmen and metal fabricators for its various plants.

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Pennsylvania Salt Mfg. Co. has promoted *Gustave A. Nelson* from Works Manager at Wyandotte, Mich. to general engineering and consultive work in connection with company expansion plans.

James M. McWhirter, Southern Works Manager, has been named to Nelson's former post.

Nelson has played an important part in some of the companys most profitable developments in chlorine and caustic soda production and in several fields of electrochemistry.

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The September meeting of the Detroit branch of the *American Electroplaters' Society* was held at the Statler Hotel on Friday, September 5.

After the showing of a movie, "*The Jet Story*," a film telling the story of the manufacture of jet engines by the *General Electric Co.*, the principle speaker of the evening, *Fred Kraatz*, was introduced. Kraatz who is Technical Service Manager of the *S. C. Johnson Co.*, Racine, Wis., talked on protective wax coatings in industry and their particular application over plated coatings in these days of substitute finishes.

Refreshments were served after the meeting.

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Dun-Rite Metal Industries, job polishers and buffers, have moved to new and larger quarters at 24220 Mound Rd., Centerline, Mich. from their old location at 810 E. Ten Mile Rd., Hazel Park.

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Industrial Metal Fabricators Co. of 8820 Lyndon, Detroit has added a new addition of 5000 square feet of working area. This addition, the fourth since the company started in January, 1940, will be used for assembly only and has full crane facilities over its entire area.

C. F. Turner, managing partner of the company, said that in view of the concern's output of diversified products, the new addition would have been necessary without the extra need for facilities to handle its defense production assignments, which now account for about 60% of the company's output.

Industrial Metal Fabricators produces industrial washing machines, ovens, draw furnaces and a recently developed machine for separating oil and water.

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Detrex Promotes Two in Industrial Sales Division

The promotion of *L. Camel* to the position of Divisional General Sales Manager of the Industrial Chemical Division and *D. E. Williard* to Divisional General Sales Manager of the Industrial Equipment Division is announced by *W. F. Newbery*, Director of Sales for the *Detrex Corporation*.

Mr. Camel will direct the sale and service of the Chemical Division products which include: emulsions and alkali cleaners, strippers and spray booth compounds; phosphate coating processes for rust-proofing, paint bonding and the cold extruding of steel; and the silicone coating removal processes and cleaning compounds for the Food Processing Division.

D. E. Williard at left and L. Camel, right, developing new sales and service plans with W. F. Newbery, Director of Sales at Detrex.

Mr. Williard will control the sale and service of the Detrex line of solvent degreasing machines and solvents, and the mechanical washers used in industrial production cleaning.

These changes represent another improvement in customer market and service relationships.

News from California

By Fred A. Herr

Swanney, McDonald & Williams, manufacturers of automotive parts, have construction underway on a new plant for fabricating and polishing stainless steel automobile trim parts at 2929 Ontario Ave., Burbank, Calif.

Representing an investment of $100,000, the new plant will have 22,400 sq. ft. of area under roof and 25,000 outside. Automatic and other polishing facilities of various types have been installed. Completion is expected by December 1, when the facilities now housed at 4526 Cutter St., Los Angeles, will be moved into the new Burbank plant. *J. F. Swanney* and *Harry Williams* are partners in the firm.

The new owners of *National Heat Treating Co.*, Los Angeles, which was recently sold by *Ross Perrino*, have completed incorporation and have elected *David Pullen* as president and *George Shaw*, secretary-treasurer.

New West Coast Plant for American Chemical Paint Co.

The *American Chemical Paint Co.* announces that it has acquired office and plant facilities on the West Coast and expects to be operating there about the first of November.

George H. Williamson

The new ACP plant is located at Niles, Calif., which is about 25 miles southeast of San Francisco. Present plans include the production of metal-working chemicals (rust proofing and paint-bonding phosphate coating chemicals, pickling acid inhibitors) and agricultural chemicals (plant hormones and "Weedone" weed killers).

Heading up the Niles' ACP branch will be *Mr. George H. Williamson*, for many years associated with the company in a supervisory capacity at its Detroit, Mich. office. In addition, field representatives will provide technical servicing and consultation for ACP customers in the West Coast area.

Visitors to Los Angeles on business trips during September were *L. K. Lindahl*, president of the *Udylite Corporation*, Detroit; and *D. J. Swaninger* of the buffing composition department of *Frederic B. Stevens, Inc.*, Detroit. Conferences with *Jack Raskin*, head of the plating supply division of *L. H. Butcher Co.*, Los Angeles, were on the schedules of both Mr. Lindahl and Mr.

Swaninger. L. H. Butcher Co. and the Stevens Co. now are subsidiaries of Udylite.

Barber-Webb Co., Inc., on September 1st opened a new plant at 3864 Santa Fe Ave., Los Angeles, into which the facilities for plating and processing tanks, plating racks, basket coating and other departments have been moved from the former plant in South Gate, Calif.

Allyn E. Webb, vice-president-general manager, reports the new plant contains 41,000 sq. ft. of area, quadrupling the former facilities. Building, remodeling and new equipment represent an investment of $85,000.

Among new departments is one involving new processes for application of recently developed plastic materials. The new plant also contains fully equipped departments for lining tanks with Koroseal as well as with the Paraline series of acid resistant materials. The installation of acid and carbon brick sheathing is handled in the same department. This work will be done at the new plant as well as at the plants of customers. The firm is exclusive licensee in this area for *B. F. Goodrich Company's* Koroseal tank lining material as well as for the products of *American Anode Co. Stoner-Mudge* and *United Chromium* products also are used in connection with its protective coating applications.

Donald B. Barber, president, announced that the firm's technical staff was augmented September 1 by the addition of *George Bouffard*, formerly with *Proctor & Gamble*, Chicago, who is now serving Barber-Webb as chemical engineer. Other staff promotions or additions are:

William C. Pearce, promoted to manager of aircraft part's division: *Phil Simon*, named assistant to Mr. Webb and will now concentrate on sales engineering problems; *Douglas Goodan*, formerly with *Pan American Airlines*, named assistant to Mr. Webb in charge of plant and field operations; *Vernal Jones* named supervisor of dipping and spraying departments, and *Paul Everett*, supervisor of tank lining department.

"*Old Soldiers Newer Die*" says the song immortalized by *General Douglas MacArthur*, and the same thought might be applied to old platers. They may sell out and presumably "retire," but it doesn't take much persuasion to bring them back to the job, if only temporarily. And so with *Earl Coffin* of Los Angeles, who some months ago sold his *Palace Plating Works* and retired to a Life of Riley. When *Cliff Pierce*, present owner of the job shop which Earl operated for a quarter of a century, had to make a business trip to the middle-west in September, he phoned Earl to help out during his absence. Earl responded with alacrity, and apparently had the time of his life doing the things in the shop he formerly regarded as hard work.

William "Bill" Nairn, supervisor of the plating supply division of the *A. J. Lynch Co.*, Los Angeles, in August was recalled for two weeks military service at Camp Stoneman, near Pittsburgh, Calif. During World War II, Nairn served as a first lieutenant of the 27th Division, seeing service in the Gilbert, Marshall and Marianas campaigns, at Okinawa and in Japan. He was recently appointed to head the Lynch Company plating supply department when

Jack Beall resigned to join *Tom Turner* and *Hal Wells* (both Lynch alumni) in forming the *Crown Chemical & Engineering Co.*, Los Angeles.

Paul Franke of the *Price-Pfister Company's* plating department in Los Angeles, apparently has his automobile equipped with tires that give a mileage equivalent to the seven league boots of old. Paul hopped into his car on a Tuesday recently for a motor tour through California and the Pacific Northwest. He returned five days later with 1997 miles showing on the speedometer. His tour included a stop in San Francisco, then up the Redwood Highway to Eureka, Calif., Grant's Pass, Eugene and Klamath Falls, Oregon, a stop at Hidden Lake, and back down U.S. 101 to Los Angeles and the P-F plating room.

The Extension Division, *University of California at Los Angeles*, on September 16 opened night school classes in the science and practice of electroplating. The 1952 Fall series follows the pattern of instruction and class frequency of previous courses in this field, which have been sponsored by the school in past years.

The full course includes 18 sessions which are held once a week on Thursday from 7 to 9:30 p.m., beginning September 16. The course is again directed by *Mitchell Raskin*, Los Angeles consulting engineer, who brings to the instructorship a background of practical plating experience gained by years of service as plating supervisor for various Los Angeles finishing and manufacturing firms.

The course embodies a comprehensive survey of the science, techniques and practices involved in the various methods employed in electroplating for those engaged in some aspect of the field who wish to broaden their knowledge and experience. It includes the chemistry of plating; plating and cleaning equipment; cleaning, pickling and stripping methods; racking of parts, filtering, health and safety practices, plating problems and their solutions, and types of plating from brass to zinc.

Two other courses of less direct interest to platers are being offered. One deals with recent advances in physical metallurgy, with *Delbert M. Van Winkle*, research physicist of the *Hughes Aircraft Co.* as instructor. The other course concerns applied ferrous metallurgy, of which *Orlo E. Brown, Jr.*, metallurgical engineer of the *Fletcher Aviation Corp.* is the instructor.

Fire early in September caused damage of $25,000 to equipment, material and the plant of *Products Research Co.*, Glendale, Calif.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Los Angeles Branch

Ninety members and guests attended the September 10 meeting of *Los Angeles Branch*, American Electroplaters Society, in Rodger Young Audi-

torium, Los Angeles, which marked the resumption of monthly meetings following a two-months vacation period.

After the conclusion of the customary social hour from 6 to 7 p.m., dinner was served, and the business session was called to order at 8 o'clock by President *Myron Orbaugh*.

Visitors introduced included: *Harold Placies*, Keystone Plating Company; *James M. Sowell*, Federated Metals Division, American Smelting & Refining Co.; *D. J. Swaninger*, Frederic B. Stevens Co., Detroit, Mich.; *F. M. Sutton*, Harshaw Chemical Co.; *Ernest Taylor*, General Electric Co., Ontario, Calif.; and *Jerry Nahring*, Adams Rite Manufacturing Co., Glendale, Calif.

Librarian *Stuart Krentel* requested an expression of opinion from members concerning their wishes in regard to future speakers at branch meetings. He pointed out that due to Los Angeles' geographic location, the branch finds it difficult to obtain many good and timely speakers who are available to branches in the more conveniently situated cities of the Middle-West and East.

Various members suggested the problem could partially be resolved by more frequent scheduling of local talent in the form of job shop owners or plating department supervisors with programs on practical plating subjects. More frequent panel discussions, with several speakers presenting 15-minute talks on different phases of the same subject, followed by open forum discussion by the members, was also suggested. This latter form of program, it was pointed out, has always proved popular in the past, and the educational committee chairman was requested to attempt to schedule several such programs each year. Krentel also requested the members to keep him posted on possible speakers for the branch's next annual educational session in March, 1953.

Earl Coffin, chairman of the Research Committee, reported two additions to the branch's role of Research Program Sustaining Memberships. These are Metallon Corporation, Huntington Park, Calif.; and Alert Supply Company, Los Angeles.

The delegates to the Supreme Society convention presented a report of their observations at the Chicago conclave. *Fred Raymond*, chairman of the picnic committee, reported a good time was had by all who attended the outing in South Gate Park on June 29, and that the baseball game (which the Platers team won by a 22 to 21 score over the Suppliers) was a vigorously performed, if not scientifically executed, version of America's national pastome.

Due to the crowded program of the business session, the initation of applicants for membership was postponed until the October 8th meeting.

The principal speaker of the meeting was *H. E. Donaldson* of the General Chemical Division, Allied Chemical & Dye Corporation. Mr. Donaldson discussed "*Fluoborates in the Plating Room*," illustrating his formal talk with illuminated slides dealing with the chemical formulae and make-up of fluoborate baths. Since fluoborates are coming into greater prominence every day, the talk was one of timely interest to the members and guests.

AMERICAN SOCIETY FOR METALS

Presentation of two top awards will be the feature of the annual dinner of the *American Society for Metals*, Thursday, October 23, 1952, which will be held in the Grand Ballroom of the *Benjamin Franklin Hotel* in Philadelphia, Pa.

Dr. Robert F. Mehl, Head, Department of Metallurgy, Carnegie Institute of Technology, Pittsburgh, Pa., is the 1952 recipient of the American Society for Metals' Gold Medal.

ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS, INC.

This association will hold its annual *Open Door Dinner* meeting October 28, 1952, 5:00 P.M., Hotel Belmont Plaza, New York City.

CHICAGO ELECTRO-PLATERS INSTITUTE

Carl F. Hansen, Chairman of the *Chicago Electro-Platers Institute*, recently announced that the Institute's $2,500 reward offer to stop thefts of critical metals in the Chicago area has been extended to August 31, 1953.

The reward was initiated a year ago by the Institute following a series of thirty thefts of allocated metals from shops of member firms. Valued at $50,000 at normal market prices, these metals brought a reputed $250,000 on the "gray" market throughout the country.

During the past year, seven defendants have appeared on metal theft charges. On August 8th, *Robert Spies*, confessed burglar of five electroplating shops, was convicted of three of these burglaries. He is now in Joliet prison serving concurrent two-to-three-year sentences for the three thefts. Another defendant in the same case is awaiting trial.

The Institute, which represents nearly 100 job-shop metal finishing firms in the Chicago area, also announced that since the reward offer was made in September, 1951, only six metal thefts have been reported.

AMERICAN SOCIETY FOR QUALITY CONTROL

This Association will hold the 7th Midwest Quality Control Conference at Indianapolis, Indiana, on November 20-21, 1952.

LETTER TO THE EDITOR

EDITORIAL OFFICE
METAL FINISHING
381 Broadway
Westwood, N. J.

Dear Sirs:

For some time now I have been a reader of METAL FINISHING and wonder if you could help me to get in touch with American manufacturers.

I have my own factory in the Argentine and am interested in finishing novelties. Since we cannot import the novelties I would like to enter a licensing arrangement with a manufacturer or anyone holding a patent on this type of finishing, to do the work here.

Any help which you can give me along these lines would be greatly appreciated.

Very truly yours,

JOSE MITTERWALLNER
Avenida Lavalle 1631
Florida FCNGBM
Buenos Aires, Argentina

OBITUARIES

JAMES J. O'SHEA

Mr. James J. O'Shea, Vice President and Sales Manager of the *Alsop Engineering Corp.*, Milldale, Conn., died Tuesday, August 19th after a brief illness.

Mr. O'Shea, a pioneer in the field of industrial mixing and agitation, had been with the Alsop Engineering Corporation for 18 years.

He was born in New Castle, West County Limerick, Ireland, and came to the United States when he was 16 years old. During World War I he served two years in the Army and saw service at Chateau Thierry, Aisne, Marne, Meuse-Argonnes and St. Mihiel.

Upon his return he joined the *Western Electric Corp.*, in a New York, where he attended company schools, and became a member of its tool and die department. He joined Alsop Engineering Corporation in 1934 and worked in the developing of new types of chemical and industrial agitators and mixers.

One of his developments was an agitator unit for the electroplating process. It was widely used during World War II in the electroplating of bearings for aircraft engines.

In his position with Alsop Engineering Corporation, Mr. O'Shea was in complete charge of the mixer, agitator and tank departments in both production and sales.

He was a member of the Exchange Club, the Chamber of Commerce, the Hartford branch of the American Electroplaters' Society, the Southington Country Club, the Second Indian Head Division Association of World War I of Camden, N. J., the American Legion, and the Benevolent and Protective Order of Elks.

HUGH J. FRASER

Hugh J. Fraser, Vice-President in General Charge of All Plant Operations in the United States of *The International Nickel Co., Inc.*, died Friday, August 22 after a brief illness, in his 55th year. He resided at 45 Woodbine Ave., Larchmont, New York.

Born in Brockville, Ontario, the son of *Oliver K. and Margaret A. Fraser*, he attended Queen's University at Kingston, Ontario, graduating in 1923 with a Bachelor of Science degree.

Mr. Fraser joined the Huntington (West Virginia) Works of The International Nickel Company, Inc., in May, 1923, serving in various technical and operating capacities before being promoted to the company's New York Office in February, 1935, as Assistant Manager of the Production Department. He was elected Vice-President in March, 1947, and in the following June was made Vice-President in General Charge of All Plant Operations in the United States of International Nickel. He was also an Assistant Vice-President of the parent organization, The International Nickel Company of Canada, Limited, since June, 1943.

Mr. Fraser was a member of the Canadian Institute of Mining and Metallurgy, American Institute of Mining and Metallurgical Engineers, American Society for Metals, the Mining and Metallurgical Society of America and The Canadian Society of New York. He was also a member of the City Midday Club, New York, The Mining Club, New York, and the Larchmont Yacht Club, Larchmont, New York.

Surviving are his widow, the former *A. Muriel Dunne*, formerly of Ottawa, Ontario: two daughters, *Joan* and *Dorcas*, and two brothers, *O. B. J. Fraser*, of Westfield, N. J., and *C. E. Fraser*, of Toronto, Ontario.

A Solemn High Requiem Mass was celebrated for Mr. Fraser at St. Ignatius Loyola Church in Montreal on Monday morning, August 25.

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